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BASING RATES UPON COST OF SERVICE.

A communication is printed in this issue relative to an editorial entitled "Value of the Service and Cost of the Service," which appeared in the issue of December 12. The writer of this communication advocates rates based on the cost of service and objects to any consideration of value of service in adjusting the various schedules which go to make up a system of rates. The editorial in question referred to the last report of the Rate Research Committee of the National Electric Light Association, and the criticisms of it which have since sprung up, and attributed some of these criticisms to a lack of understanding of the points involved. Further, citations from public-utility commissions were made showing an appreciation by such bodies that in adjusting rates for different classes of service, the value of the service should be taken into consideration. It is not necessary here to make any defense of the proposals of the Rate Research Committee; that body is amply able to speak for itself. But it is evidently desirable that our own views on this subject should be further elucidated.

There are evidently two practical limits to any rate for public service, outside of which service cannot in the long run be furnished: the upper limit is the value of the service or what the traffic will bear; the lower limit is the cost of the service. What intermediate value would be fixed by any corporation without restraint and without competition would be a matter of policy determined largely by the effect of the rate on the volume of business. Under regulated monopoly we believe rates should be adjusted on the basis of cost of the service, using the term cost in the widest sense to include the cost of capital, of organization, of building up the business, and of maintaining the plant unimpaired, as well as the cost of operation. It may be noted here that it is not necessary to add any "profit" to these costs in determining prices or rates, for as that term is commonly used, it is included in the cost of capital.

We believe that the Rate Research Committee, Professor Jansky and most public-utility commissioners will agree with us in setting down total cost as the mark to be aimed at in determining the total income of a public service company. We believe further that individual consumers should pay the costs of their respective services insofar as it is feasible to determine those costs, and for that reason consumers should be classified according to the char-

acteristics of the service required. It will be generally agreed that it is not feasible to determine separately the costs incurred on behalf of each individual consumer, and that even for classes of consumers it is difficult to properly distribute the expenses incurred in common. That charges for electric energy made upon a meter basis should be varied according to maximum demand, time of this maximum, power-factor, hours of use and total amount of consumption, is universally conceded. Attempts have been made to provide for this by means of a separate demand charge and a separate consumer charge, but this leaves the questions of power-factor and time of consumption unconsidered. If every item affecting the cost of service could be included in a price list, the necessity of classifying customers would be obviated. But probably no two officials would work out the same schedule for the same utility, and when one was completed it would be hopelessly complicated. This complexity alone would be sufficient to condemn it, as is evidenced by present railroad rates. The majority of consumers of electric energy are household users, to whom even a kilowatt-hour is a thing of mystery. Most shippers of freight are business concerns, many of which employ freight-rate experts to see that their freight is properly classified and charged for. These employees are largely occupied in making claims for overcharges and every railroad keeps a force of men busy investigating such claims. Such claims are usually proper ones because the expert is more familiar with the classifications affecting his own goods than is the average freight agent who makes out the bill of lading. With so much difficulty arising among men whose business it is to understand the rates, it is evident that no complicated system would be satisfactory to the average consumer of electric energy. It may be noted in this connection that even electric rates are becoming so complicated that a central-station representative recently became muddled in attempting to explain his own rates to a group of listeners whom he had come prepared to enlighten.

Complexity is, however, not the only objection to a system which attempts to properly apportion all elements of cost. Just how fixed charges should be allocated between loads coming on the peak and off the peak is largely a matter of opinion and the point of view. "Who shall decide when doctors disagree?" And even an equitable distribution of consumer and demand charges is a matter of great difficulty. The consumer cost, like the energy cost, can, however, be approximated with sufficient precision. In the absence of precise formulas, the value of the service can well be used as a guide in determining the distribution of the remaining costs, consisting largely of fixed charges.

When an additional class of service can be added to the existing load of an electric utility for a return which is smaller than the average cost of units already supplied, yet larger than the additional costs imposed by the additional service, there is an opportunity to apply this principle for which the Rate Research Committee contends. We agree with Professor Jansky that this extension of load is not justified unless the added income *more* than covers the added cost, so that something is contributed to the common expenses. When this is accomplished we see no objections, since less general expense now falls on the old classes of business, which are then entitled to a reduction in rate on the principle that total income should be adjusted to total cost.

It must be admitted that this practice opens the way to difficulties. If, for instance, a rate for off-peak load, open to all, attracts so much load that a new maximum is created at former off-peak hours, what is to be done? Additional business cannot be refused without discrimination. If additional facilities are provided to take care of the load, the costs would probably exceed the income from this source. If rates are raised, much of the business might be lost, as well as hardship imposed on those who have established a business dependent upon the low rate. Of course, in some cases, adjustments could be made, as in the case of electrochemical operations, so as to prevent coincidence of peaks. In other cases, such as vehicle batteries which must be charged between 10 p.m. and 6 a.m., no such adjustments can usually be made.

One other point deserves mention. It is customary to place all residence lighting in one class, based on a meter rate, with perhaps a minimum monthly charge. In the aggregate this class of consumers, at prevailing rates, provides an income which not only covers the cost of service, but in many instances, such as the one quoted by Professor Jansky, yields an added profit to the owners of the utility. In this class of customers there are nearly always individuals, however, whose consumption is so small that their payments do not cover the costs involved. The consumer costs are frequently higher than the minimum charge, and some companies do not even make a minimum charge. Such customers are served at a loss which must be made up by larger users. Many instances occur where service lines and meters must be provided for a single lamp outlet. If a proper share of cost for pole line, transformer, mains, etc., is added, and then current enough supplied to bring the meter charge up to the minimum, a slight computation will show the unprofitable nature of such a customer, especially if service is discontinued at the end of the year. A separate consumer charge would properly cover such cases, but this form of schedule is not popular and is not generally considered expedient for this class of consumer. Either such a charge, or a separate classification for the very small user, would often prove prohibitory and create ill will, and it has not been favored by either utility companies or public service commissions.

SOUTH AMERICAN TRADE.

Much has been heard since the European war broke out regarding the possibilities of export trade for American manufacturers and particularly with regard to South America. Prospects for such a foreign trade expansion appealed particularly to electrical manufacturers, owing to the fact that this line of export to South America, with the possible exception of Brazil, had been largely dominated by England and Germany, and to the dull condition of the market at home. The possibilities of trade expansion for American manufacturers and exporters were largely overestimated at first, because of a number of influences which were not fully reckoned.

While it is true that Germany's foreign trade has been largely interrupted, that of England has been little interfered with. On the other hand the purchasing power of the South American countries has been partly destroyed by the reduction of their exports to Europe, and the general financial stringency has been felt there as much as elsewhere. There has been little or no trouble with transportation facilities, and vessels destined for South American ports have been unable to secure full cargoes. Undoubtedly lines with regular sailings will be available as soon as there is an established and steady succession of shipments which will warrant it. But trade cannot be established in a day and the American electrical manufacturer who goes into this market should do so with full preparation and with the expectation of slowly building up a permanent business on such a basis that he can compete with his rivals in Europe.

Suggestions which will aid in such preparation are given in a serial article by Mr. G. F. Bagge-Féron, the first installment of which appears in this issue. The author is well acquainted with business conditions in South America, as well as other foreign countries, and he points out the necessity of familiarity with the language, the customary weights and measures, and the business practices of the prospective customer. Especially with respect to customary credits and methods of shipment is this necessary. Moreover, the tastes and prejudices of the customer must be considered, and designs of lamp shades, for instance, which are popular in this country might meet with no sale there. Electric cooking apparatus should meet with especial favor in countries where fuel is scarce, and especially in the tropics.

Technical considerations must also be kept in mind when offering machinery and current-consuming devices. Operating voltages and frequencies vary more than in this country, and heating devices especially need to be adjusted for the operating voltage. In Brazil, 110 and 220 volts are common, due perhaps to more intimate relations with this country, and fortunately nearly all South America is accustomed to the Edison screw socket. Open wiring is very common. In tropical countries, the special climatic conditions and insect pests must be considered in reference to cables and other apparatus to be used outdoors, and it must be remembered that motors and other machinery cannot carry the overloads which would be harmless at lower temperatures. Where accessories are required it is advisable to include them with the main apparatus, and offer a complete outfit, as the securing of what is here considered standard supply material is not always easy.

Future installments will take up local conditions, especially with reference to Argentine Republic, which is one of the most progressive of the South American countries, and which contains the fourth city of the American continent. Buenos Aires ranks next to Philadelphia in population. Banking exchange with the Argentine Republic should be placed in a favorable condition by the recent sale in this country of $15,000,000 of that government's bonds, which have been floated during the past two weeks by a syndicate of banking houses. The eagerness with which this issue was oversubscribed indicates the presence of ready capital which will be invested when attractive securities are offered.

THE TIME FOR EXTENSIONS.

The last six months of 1913 witnessed a financial market which was not conducive to the inauguration of new enterprises of the nature of electric utilities nor even to the natural development of extensions which would take place in normal times. At the outbreak of the European war the market was flooded with securities, the stock exchanges were closed, and prices for securities took a pronounced drop. The price level of a year ago is not likely to be reached for a long time, even though interest rates for commercial loans are back to about normal.

The prevailing rate of interest on bonds is likely to remain high for several years. The enormous destruction of capital in Europe, the necessity of financing government expenditures now and the demand for reconstruction work after the war will be felt for some time in the future. Consequently better conditions for floating bond issues are not to be expected. The present bond market is active, and promises to become still more so. Funds for investment are always more plentiful in January than at other seasons. While the undertaking of new projects should be very carefully considered, there should be no hesitation in planning and executing the extensions which are needed in every growing community and which have been held back through fear of financial trouble. These needs must be met sooner or later and there is no good reason why they should not be met at once.

Where only small sums are required, and especially in the Central West and Northwest where crop yields last year were good and many incomes larger than usual, the advisability of issuing bonds in small denomination which can be offered locally should be very seriously considered. This practice not only offers an avenue for many small investors to put their savings into the utility field, but it helps in widening the interest that makes for good will between the utility company and the community it serves.

Wisconsin Electrical Association to Meet with Gas Association.

At a joint meeting of the Executive Committees of the Wisconsin Gas and Wisconsin Electrical Associations, it was decided to hold a joint annual convention. This convention will be on January 20, 21 and 22, 1915, at the Hotel Pfister, Milwaukee, Wis.

January 20 will be devoted to papers, discussions and matters pertaining to the Wisconsin Gas Association. January 21 will be the opening day for the Wisconsin Electrical Association, and all papers and discussions will be on subjects of joint interest to both the Gas and Electrical Associations. On January 22 subjects pertaining to electric railways and electric utilities will be presented.

This joint convention is another step forward in the history of both associations and marks the beginning of closer co-operation between the gas and electrical utilities of this state. Every public service company owner, operator and employee is invited to attend.

Papers of timely importance on financing, operation, office efficiency, and state regulation will be offered by men of expert knowledge and experience in the respective fields. "The Wisconsin Railroad Commission's Method of Rate-Making" is among the subjects of importance to be presented and discussed at the joint convention.

Program of Convention of Western Inspectors.

The tenth annual convention of the Western Association of Electrical Inspectors will be held at the Hotel Radisson, Minneapolis, Minn., on January 26, 27 and 28. The first session will be held on Tuesday at 10:00 a. m. The mayor of Minneapolis will make an address of welcome and Waldemar Michaelson will respond. President Ben W. Clark will then make his address and reports will be presented by Secretary William S. Boyd.

At the afternoon session addresses will be made by J. H. Miller on "Elevator Motor Controllers," and by J. F. Stover on "Fire Alarm Systems." Committee reports will be presented by K. W. Adkins on "Induction Motors," and by J. R. Morrisey on "Signal Systems."

On Wednesday morning Guy W. See will present the report of the Committee on Underground Systems and Frank R. Daniel the report of the Committee on Electric Traction Systems. An address will be made by Charles A. Lang on "Power in a Modern Flour Mill," and by Burton McCollum on "Electrolysis: Its Detection and Mitigation."

At the two sessions on Thursday the program includes the following: "Laws and Ordinances," by W. S. Boyd; "Approved Fittings and the Label Service," by J. E. Latta; "National Electrical Code," by F. D. Varnam; "How to Deal with the Public," by John S. Taylor; report of Committee on Rubber-Covered Wire, by Victor H. Tousley; "The Manufacturer of Rubber-Covered Wire," by Everett Morse, illustrated by motion pictures.

In the evening the monthly meeting of the Minnesota Section, American Institute of Electrical Engineers, will take place, including an address by Charles A. Pillsbury, on "Principles Entering into Valuation of Public Utilities and Rate-Making."

Any time available at the various sessions will be devoted to inspection problems and field experiences.

The entertainment features include a reception, ball and card party on Tuesday evening, an automobile tour on Wednesday afternoon, a banquet on Wednesday evening, dinner and smoker on Thursday evening, visits of inspection and luncheon on Friday. In addition to these there will be for the ladies a trip to art gallery and library on Tuesday afternoon, a tango tea on Thursday afternoon and a theater party on Thursday evening.

Boiler Efficiency.

At the meeting of the New York Electrical Society on January 13, William A. Blonck will make an address on "European Boiler-Room Practice and Boiler-Efficinecy Methods in United States, with Reference to Electric Light and Power Plants." Mr. Blonck has just returned from Europe, and with the aid of lantern slides will discuss the construction and performance of high-duty boilers as used in electric plants on the continent. He will also take up the practical question of the more rational and economical use of coal in the boiler room by the aid of definite indications of the combustion process which are simple and comprehensible to the firemen. By the means to be described work and waste may be eliminated.

The meeting will be held at the Engineering Societies Building, 33 West Thirty-ninth Street, New York City, on Wednesday evening.

Electric Club of Chicago.

The last regular meeting of the Electric Club of Chicago in 1914, held on December 31, was one of the most successful of the year and fittingly closed the most prosperous period in the club's history. A. A. Gray, managing editor of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, was the principal speaker, reviewing the electrical developments of the year.

Kansas Telephone Society Elects Officers.

The annual ladies' night and open meeting of the Missouri and Kansas Telephone Society, an organization of Bell telephone employees, took place Monday, December 28, in the Central High School auditorium.

Officers for the coming year were elected as follows: L. A. Davies, president; L. E. Shoemaker, vice-president; F. C. Penfield, treasurer; E. Schoenau, re-elected, secretary; P. H. Hopkins, re-elected, and L. Harris, executive committeemen.

The comic side of the telephone business was shown in a farce entitled "The M. & K. Hospital Corps(e) and Patients." The hospital corps was the girls who nurse the company's distressed patrons, when their complaints come in.

New York Jovians Hold Successful Smoker.

The New York Jovian League held a very successful smoker on the evening of December 23, at the Martinique Hotel. There were many prominent Jovians present and brief addresses were made by Past Jupiter Frank E. Watts, who is now First Tribune of the New York Jovian League; Martin A. Oberlander, Congressman for the New York district; Second Tribune Charles K. Wyatt, and Statesman James H. Betts. In addition to a cabaret entertainment, Statesman-at-Large Thomas H. Bibber contributed to the entertainment of the evening and was voted one of the best stentors who had ever appeared at any meeting in New York City.

Organization Meeting of West Virginia Branch.

A branch of the American Institute of Electrical Engineers has been organized at West Virginia University, and it was planned to hold the opening exercises on the evening of January 7. The principal feature was an address by Prof. V. Karapetoff, of Cornell University, on "Some Recent Developments in the Field of Electricity." This was preceded by a demonstration of the electrical equipment of the University by the engineering students, and was followed by a reception in the honor of Professor Karapetoff in Mechanical Hall.

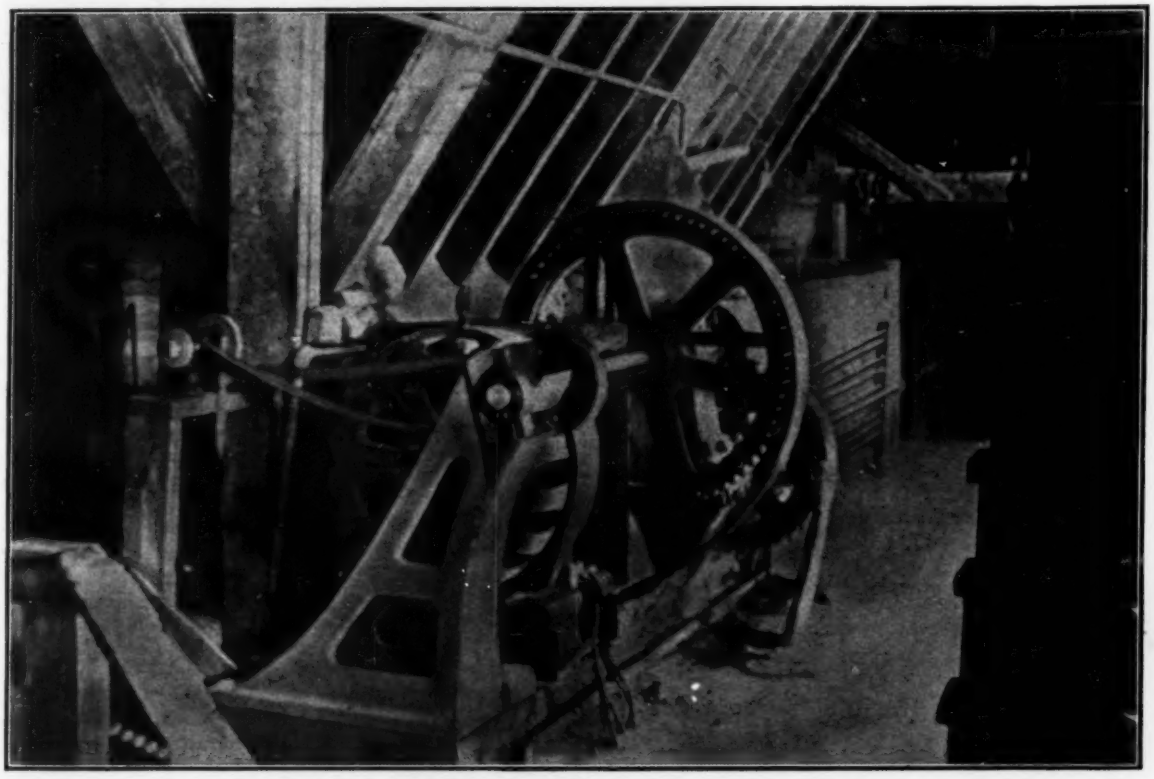
Notable Issue of Patents.

On December 29, 1914, the United States Patent Office issued a total of 971 patents on inventions and 5 reissues of such patents. This covers all the patents issued in that week, since patents are always dated on Tuesday, and is the largest total ever issued in one week.

Electricity in Brick-Making.

While the value of central-station service to the brick manufacturer may seem greater in a plant using waste heat from the kilns for drying purposes, still there is a creditable number of large establishments drying by steam and still purchasing power. Such an installation is herewith described, together with general data on horsepower requirements of brick-making machines.

In the up-to-date brick plants equipped for electrical operation throughout, a great variety of motor applications is found. The clay is excavated by electrically operated shovels and loaded into transfer cars hauled by electric traction to stock piles, where, under action of rain and frost, it is weathered and partially disintegrated. From the stock piles the clay, especially the harder shales, is transferred to the motor-driven roll crushers or dry pans, and screens, and then by cup conveyors to the pug mill. From the pug mill the now thoroughly mixed and tempered mass is delivered to the augur brick machine, where it is forced through dies carefully designed to produce a true cross section with maximum uniformity of density, in the form of a continuous rectangular column. A frame carrying tightly strung piano wires or suitable knives rotating at the proper speed, cuts the issuing column of clay into standard size blocks or bricks. The green bricks are carried by a belt conveyor, which moves somewhat faster than the column issuing from the augur, and consequently separates the bricks slightly, to the represses, where they are forced into molds and subjected to heavy pressure. This operation smooths the surface and squares up the corners. The brick is then ready for the drying house and kilns.



Pug Mill in Brick Yard Gear-Driven by a 40-Horsepower Squirrel-Cage Motor.

In addition to the machines mentioned electric motors find a most satisfactory application driving centrifugal or geared pumps for removing excess water from the clay pits and also for driving large ventilating fans in the drying house.

One of the most model and complete installations in a brick plant that involves the operations mentioned, is that of the Chicago Brick Company, located in an outlying suburb of Chicago, known as Riverdale. About two years ago this company abandoned its isolated plant, and now purchases all of the energy used from the Commonwealth Edison Company.

The Chicago Brick Company has been in operation at its present site for about 13 years, and has clay on its property for 15 years further production. The depth of the available clay bed varies from 30 feet to 80 feet, but has been excavated only to the 30-foot depth. About two feet of soil on top is mixed in with the clay.

Excavation is accomplished by means of a Bucyrus steam shovel, although electrically operated shovels have been tried. The present shovel is rated at 65 tons, and has a scoop of 2.5-yards capacity. It is of the single-end type, having an independent self thrust. Modern equipments should be of the revolving type, on account of the ease of changing positions to handle clay or avoid cave-ins. The shovel has been in continual service for 13 years, during which time the cost of repairs has aggregated only $1,000.

The transportation of the clay from the pit to the mill is accomplished by means of a third-rail traction system of interesting design. There is approximately one-half mile of double-

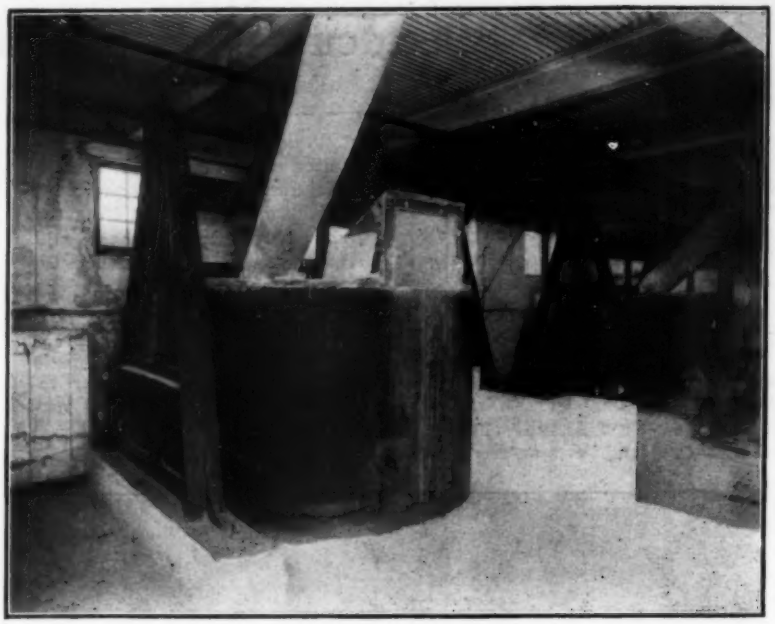
track laid from the shovel in the pit to the hoist. This trackage is divided into six sections controlled from two stations. Insulated leads are run on temporary construction to the third-rail sections. Control of the cars is by simply energizing the third rail, and as every section of the system is in full view of the operators in the control stations the system is simpler and more efficient than employing locomotives.

In the early days of the plant men and horses were used to transport the clay. This not only entailed a heavy cost for horse flesh, but also it was impossible to carry on work during adverse weather conditions. Under the present system work is carried on in the pit continuously and considerable savings are effected.

The motor cars of the system are each equipped with a 7.5-horsepower 220-volt direct-current motor, there being seven such equipments in service. Each car has a capacity of five yards of clay.

After being hauled up the incline to the mill the clay is dumped into the granulator, from which the cycle of operations pass the clay through various machines to the moving belts, where the formed bricks are picked off by 10 men and stacked on trucks ready for drying.

A 75-horsepower motor running at a speed of 900 revolutions per minute operates the hoist, which raises the cars filled with clay from the pit to the hopper of the granulator. The latter machine is operated by a 150-horsepower motor running at a speed of 720 revolutions per minute. Clay from the pit is received by this machine and worked into a plastic state by revolving knives. From here the material goes to the rolls, driven by a 35-horsepower motor running at 900 revolutions per minute, which further works the clay, removing stones, etc. The pug mill, which next handles the product, receives the worked clay from the rolls on a belt conveyor, driven by a 10-horsepower motor, running at 1,200 revolutions per minute. The pug mill is operated by a 75-horsepower motor running at a speed of 900 revolutions per minute.



Clay-Mixers Driven by Motor.

From the pug the clay is passed to the auger or brick machine, which forms the brick. This machine is driven by a 200-horsepower motor running at 900 revolutions per minute.

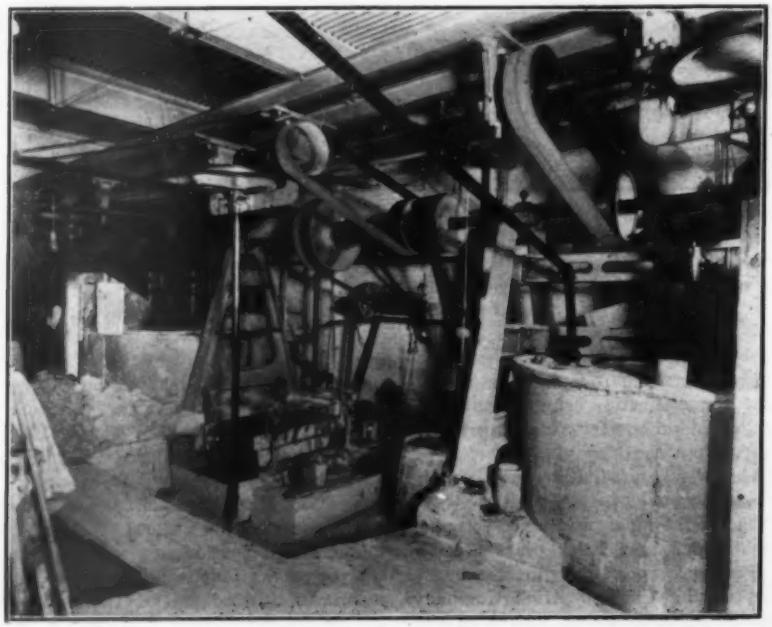
In connection with the auger, Mr. McLaughlin, superintendent of the plant, has devised a steam lubrication system for the dies, which materially increases the production. On a test made by the Commonwealth Edison Company the following results were shown.

Operating the auger the regular way, without steam, 532 bricks were formed per minute, requiring 151 horsepower to operate. Operating the auger the present way, with steam, 616 bricks were formed per minute, requiring 130 horsepower to operate.

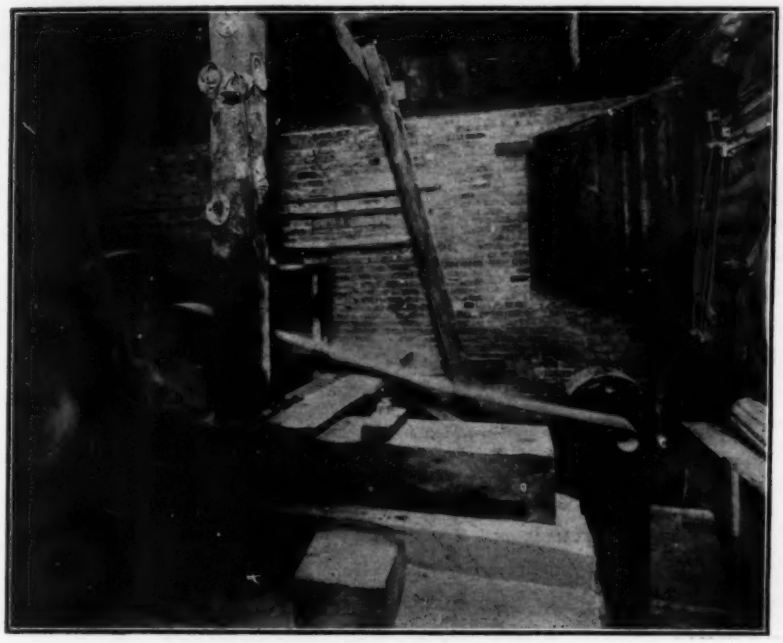
For the eight hours' operation the superintendent estimates 2,400 pounds of coal are burned for this purpose. However, a small boiler located adjacent to the brick machine would save two-thirds of this, which is now lost in transmission and low firing efficiency.

The output of this machine varies from 260,000 to 350,000 bricks per eight-hour day. There are many shutdowns incident to the operation of this class of machinery, although these are negligible when compared with conditions before the adoption of electric motor drive. The working hours are from 7:00 a. m. to 3:40 p. m. By operation during these hours the company is enabled to purchase power on the off-peak basis, resulting in a considerable reduction in the rate.

The next operation is drying the brick. Trucks holding 817 bricks each



Group of Motor-Driven Clay Machines.



Motor Driving Shafting in Brick Plant.

are placed in the drying ovens for a time varying from 16 hours in summer to 30 hours in winter. Two furnaces, burning in summer 80 tons of slack coal and in winter 100 tons, per million bricks, furnish heat which is circulated by two 50-horsepower fans through the drying ovens and out through stacks. Coal costs $1.70 per ton. The furnaces are equipped with Murphy stokers, operated by two three-horsepower motors. The Chicago Brick Company's plant is equipped with two ovens, each having 18 tracks, with a capacity of five trucks per track.

After sufficient time has elapsed for the drying the trucks are pulled through the drying ovens to the transfer track, where by means of an electric crane the brick is placed in the kilns.

A 30-arch kiln built up contains 1,150,000 bricks. A layer of burned brick forms the outer layer, over which is placed a coating of mortar. The arch is built up in a tunnel shape, allowing considerable space between the bricks for draft. The kiln is fired by means of a double burner for oil and steam for each arch. The crude oil at about 10 pounds pressure, is vaporized by steam at approximately 50 pounds pressure. Two 125-horsepower boilers produce the steam. A kiln, burning, requires approximately 70 hours of heating, using 35 tons of slack coal and 18,000 gallons of crude oil. During the burning the draft creates an intense heat, approximately 2,100 to 2,300 degrees, Fahrenheit. The kiln is allowed to cool several days before loading the brick for shipment.

The accompanying data are the results of tests conducted at the plant during three successive months' operation:

DATA ON OUTPUT OF CHICAGO BRICK COMPANY.

	July.	August.	September.
Connected load...	H.P. 888	H.P. 888	H.P. 888
Maximum demand	K.W. 320	K.W. 336	K.W. 336
Consumption	KWH. 74,728	KWH. 71,608	KWH. 70,408
Production brick.	5,935,000	5,626,000	5,131,000
Hours operating..	202	191	174
KWH per 1000 brick	12.6	12.7	13.7

Additional data on this plant are given in the accompanying data sheet.

The management is greatly pleased with electrical operation as compared with the previous steam driven arrangement. The old engines and appliances have been removed from the plant.

In connection with brick plants in general, reference should be made to an article appearing in the issue of May 11, 1912. Here the various general considerations were discussed and data given on the operation of several typical plants. It may be well to state here that the machinery required and the methods adopted in the manufacture of bricks are governed largely by the nature of the raw material available and the desired character of the finished product. For the most part a careful selection from the great variety of standard motors built for general industrial service will fully meet the requirements of clay-working machinery. The range of so-called standard motor design is so great, however, that when new installations are contemplated, it is often to the advantage of the customer to take up with the manufacturer the requirements of each proposed application.

In general alternating-current induction motors fully meet the requirements of clay-working machinery. They are of simple construction with large overload capacity, and have no wearing parts except the bearings or slip rings, which in every case are of ample design. The particular form of induction motor to use will depend upon the capacity of the distributing system and service characteristics, including such considerations as frequency of starting, starting torque,

Abandoned Engine in Brick Plant, Showing Motor Connected to Flywheel.

Brick-Making Data.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for twenty-four hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Chicago Brick Company, Chicago, Ill.

This plant operates on an average of 7.5 hours per day, 26 days per month.

The average daily production is 230,000 bricks per day.

There are 18 motors installed, having an aggregate rating of 888.5 horsepower.

The average monthly consumption is 71,000 kilowatt-hours.

The approximate electrical energy consumption per 1,000 bricks manufactured is 12.8 kilowatt-hours.

Load-factor, 15 per cent; operating-time load-factor, 40 per cent.

Motor Installation.

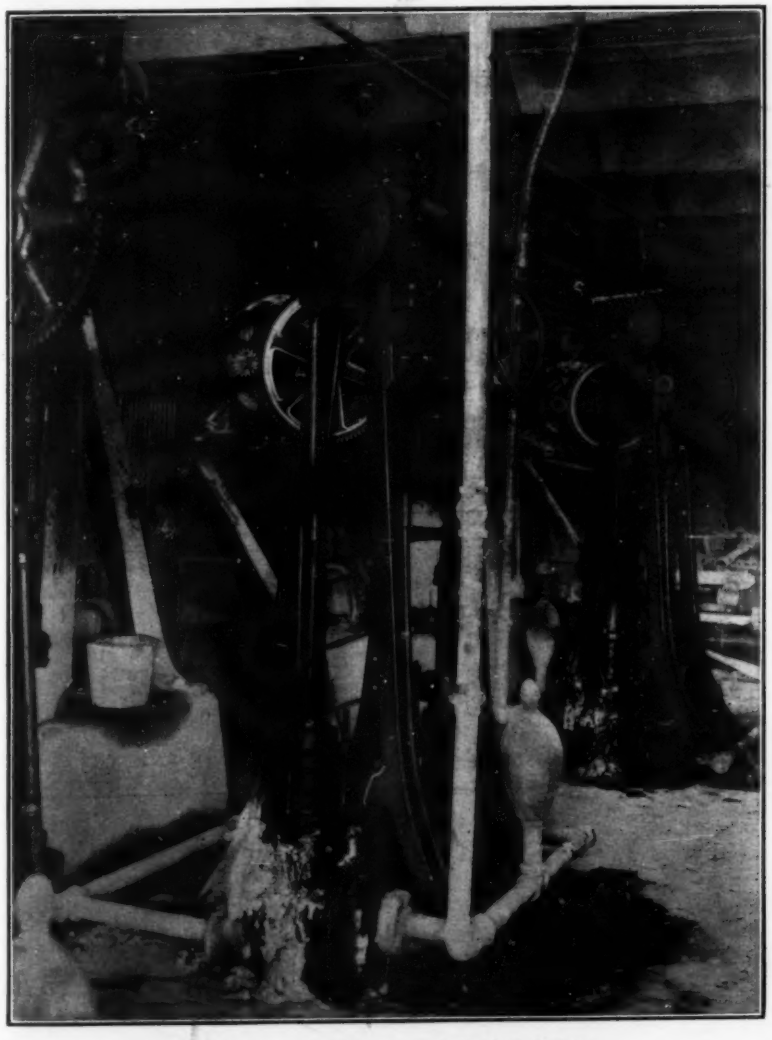
The following is a list of the motors installed with their respective drives. Energy is supplied by the Commonwealth Edison Company and stepped down in the brick company's substation to 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	200	900	Brick machine forms clay into shape.
1	150	720	Granulator receives clay from pit and works into plastic state by revolving knife.
1	75	900	Hoist, incline hoist pit to granulator.
1	75	900	Pug mill—further working of clay by revolving knives. Mixes in water or dust.
1	75	1,200	50-kilowatt motor-generating set which furnishes direct current to seven 7.5-horsepower traction motors, two motor-operated brick transfer cars, using overhead third rail; one motor-operated traveling crane, and one six-horsepower truck.
1	50	1,800	Fire pump.
1	50	1,800	No. 1 Fan.
1	50	1,800	No. 2 Fan—These fans circulate hot air from furnaces to dry rooms.
1	50	900	Centrifugal pump for emergency pit drain.
1	35	1,200	Rolls—intermediate between granulator and pug mill. Throws out stones.
1	25	1,200	Dry pan—crushes up cull dry brick for dust, to mix in clay and sand bricks.
1	10	1,200	Conveyor belt handling clay, from granulator to pug mill.
1	7.5		Elevator leg on dry pan for moving dust from dry pan to pug mill and brick machine.
1	15		Centrifugal pump for pit drain.
1	10		Centrifugal pump for pit drain.
2	3		Murphy stokers.
1	5	1,200	Machine shop for repair of machinery.

continuous or intermittent operation, reversal, etc.

For dry pans, sanders, conveyors, fans, bucket elevators and other machines with similar requirements the standard induction motor with short-circuited bar-wound rotor is usually entirely satisfactory. Each of these applications involves continuous duty at constant speed together with relatively easy starting conditions and no occasion for reversal of direction of rotation. On the other hand, for pug mills, augers, tempering wheels, hoists, excavating shovels, etc., where frequent starting and reversal, variable-speed requirements and excessive starting torque are encountered, the induction motor with phase-wound rotor and external secondary resistance, is in general recommended. This form of motor with variable secondary resistance is designed to secure maximum torque with the least possible shock to the system when starting under load.

When for any reason direct-current apparatus must be used, motors with compound windings should always be specified, except for driving fans, for which service shunt-wound motors are suitable. Where the service requirements are similar to those outlined for the induction motor with short-circuited bar-wound rotor, the direct-current motor should have the standard amount of series winding; where the induction motor with phase-wound rotor would be suitable for alternating-current service, the direct-current motor should have approximately 40 per cent of series winding and commutator and bearings should be properly protected from grit and flying mud.



Group of Pumps Driven by Individual Motors.

If motors are geared or belted direct to any of the large machines without the use of friction clutches they should be designed for a high starting torque, since when starting any of these machines full of clay a very large torque is required. Either induction or direct-current motors may be designed to meet these requirements. If friction clutches are used the motors may be started light and the load thrown on later, but this introduces another piece of apparatus subject to wear and trouble, and should be avoided where possible.

The direct-connected motor drive makes the most compact and efficient layout, but care must be taken to see that none of the laws of mechanics is violated; that is, that the foundations are solid, that gears are not run at too high speed, that they are well supported in bearings and rigid, and that the motor is not subjected to severe vibrations. The motors are not injured by the clay and dust, and if the mechanical application is well made a satisfactory drive is assured.

As to the horsepower required to drive the various machines used in the brickmaking industry, the following motor sizes are the average taken from several similar installations all having an average capacity of 100,000 bricks per day.

Machine.	Horsepower.
Electric locomotive	30
Hoist	20
Dry pan	30
Elevator	10
Pug Mill	50
No. 65 auger	90
Repress	30
Transfer car	10
Brick-setting crane	25

Additional data are given in the following table:

Machine.	Horsepower.
No. 1 Horizontal clay steamer, 20 by 10-inch	10
Eagle D. M. brick press	5
No. 42 D. M. brick press	5
R. 2 brick repress	5
No. 33 roofing tile press	8 to 15
No. 39 roofing tile press	5
No. 46 roofing tile press	4

American Clay Machinery Company.

Model.	
B-4 mold press-brick machine.	10 to 12
C-4 mold press-brick machine.	10 to 12
D-3 mold press-brick machine.	10 to 12
D-4 mold press-brick machine.	10 to 12
2 and 3 mold press-brick machine	8 to 10

American Clay Machinery Company, Auger Brick Machines.

Model.	
No. 1 giant	40 to 60
No. 2 giant	25 to 30
No. 6	15 to 20
No. 8	25 to 35
No. 10	30 to 50
No. 15	75 to 100
No. 41	30 to 50
No. 43	35 to 40
Acme	20 to 25
Centennial	20 to 30
Mascot	10 to 12
Special Giant	75 to 100

Commercial Practice
Management, Rates, New Business

White Way in Jersey City.

The installation of a new arc lamp street-lighting system, forming a "White Way," along Newark Avenue, Jersey City, has been completed by the Public Service Electric Company, and operation formally inaugurated. The new system extends from Palisade Avenue to the Boulevard, also including a section of Summit Avenue to Sip Avenue and the Five Corners. The area embraced is a portion of the business district of the city.

The opening was attended by a celebration, including a band concert and fireworks, under the auspices of a committee of the City Center Merchants' and Property Owners' Association, and terminating with a banquet at the Hofbrau Haus, Summit Avenue. Among the guests of the evening was John O'Toole, publicity agent of the Public Service Electric Company, who tendered an interesting address regarding illuminated thoroughfares. Mr. O'Toole in commending the local merchants upon their enterprise, said:

"Bright lights not only draw the crowds, they accomplish more; they conserve public safety. Every whiteway lamp is as good as a policeman; it has a fixed post. The merchant who is afraid to brightly illumine his store is not the merchant who will succeed in business. The inference is that if he is afraid to let the lights shine on his goods he has something to hide. The progressive men of this city are utilizing lighting as a means of advertising and to let the public know they want to serve them as they would be served."

Court Rules That Rentee Must Maintain Property of Utility.

An interesting case was decided by an opinion filed in court at Easton, Pa., in the suit of the Edison Illuminating Company vs. the Eastern Pennsylvania Power Company. The Edison company leased its plant to the Eastern Pennsylvania Power Company on February 1, 1900. The latter was to pay $30,000 a year rent and to maintain the general efficiency of the plant. The Edison Illuminating Company admitted that it had received the rent each year, but alleged that the defendants had abandoned the plant and allowed it to deteriorate. The plaintiffs claimed that the plant had deteriorated up to the time of the trial to the amount of $93,105.16. The defendants claimed that the Edison company had acquiesced in the changes and that there was too great delay in asserting its rights. President Judge Stewart overruled these objections and directed that the defendant company should restore the plant to the condition in which it stood on February 1, 1900, within six months from date and directed that the defendant pay the costs.

Electrically Lighted Silhouettes.

An effective and comparatively inexpensive exterior attraction for department-store advertising, for service not only during the holiday season, but also on any special occasion, is a scheme now being employed by the Filene department store, Boston, Mass.

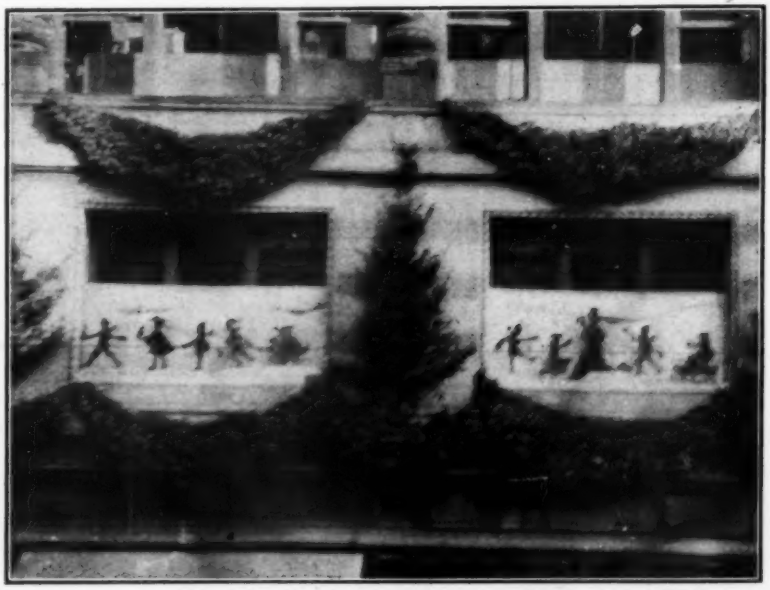
It consists of 13 groups of silhouetted figures, ranged outside the large windows of the second floor, the figures representing "Mother Goose" scenes, children at play, etc., each group standing in front of a white background painted to give the effect of landscape, frosted to represent snow.

Five of the groups are in window recesses on the Washington Street side of the building, and eight are on the Summer Street side.

Each group consists of five figures. The figures are sawed out of five-eighth-inch board, painted black. They are from 20 to 28 inches in height, and each group forms a plot or scene by itself. For example, one scene is of a group of boys and girls with sleds, coasting; another represents a skating party, and a third a witch with a broomstick, surrounded by children. All are designed especially to appeal to the little folks.

While the silhouettes attract much attention by day they are even more effective artificially illuminated. This lighting is provided for each group by means of 14 40-watt Mazda lamps, red, green, white and blue, the colored lamps being dipped rather than colored glass.

These lamps are installed, in the order named, in a tin-lined trough reflector at the bottom of a six-inch space intervening between the silhouettes and the painted background, which is of white fireproofed canvas. The light, shining upwards, throws the figures into sharp bas relief, and illuminates the sparkling snow scenes behind. A Campbell interruptor flashes the various colored lamps in intermittent fashion.



Electrically Lighted Silhouettes.

A Municipal Christmas Tree for Dayton.

Dayton, O., has a permanent municipal Christmas tree, the gift of the Dayton Power & Light Company.

Early in November, President Rike, of the Greater Dayton Association, appointed Thomas F. Kelly, sales manager of The Dayton Power & Light Company, chairman of the Community Christmas Committee, and instead of following in the footsteps of last year's committee and having a Christmas tree cut down and planted in a park for the exercises on Christmas Eve, it was suggested to the Dayton Power & Light Company that a permanent growing tree would be more in line with the modern plan of conservation, and when F. M. Tait, president of the Company, learned of the suggestion, he offered, on behalf of his Company, to purchase a live Christmas tree, have it brought to Dayton and transplanted, and hereafter used as Dayton's municipal Christmas tree each year.

Naturally the offer was readily accepted, and on December 19 a fine specimen of a 30-foot high Norwood Spruce was transplanted in one of Dayton's parks with due ceremony.

F. H. Rike, of the Greater Dayton Association, acted as chairmain, and introduced F. M. Tait of the Dayton Power & Light Company, the donor of the tree. J. M. Switzer, one of the city commissioners, accepted the tree on behalf of the city, and Dr. Garland, the director of welfare, offered a short prayer that the tree might live and grow.

The speakers were loud in their praises of the Power & Light Company's action and display of interest in the civic affairs of Dayton.

The exercises held at the tree on Christmas Eve were very interesting, consisting of the singing of Christmas carols and hymns, led by a large choir and massed band, and distribution of over 2,000 boxes of candy to the children. Gifts consisting of money, clothes, foodstuffs, etc., were also brought to the tree and turned over to the organized charities of the city, to be distributed to the needy ones throughout the winter.

Municipal Christmas Tree and Star at Dayton.

Group of City and Central-Station Officials at Dedication Ceremonies.

Dayton's Christmas celebration is entirely a community affair, as everything is donated.

The Dayton Power & Light Company, in addition to donating the tree, supplied the current for the illumination of the tree and the special lighting of the grounds and the stands for the choir and band.

The Dayton Jovian League played an important part in the affair, as it undertook at its expense the decorating and wiring of the tree and the grounds, etc., for the special lighting.

New-Business Men of Ohio to Meet in Cleveland.

The next meeting of the Committee on New Business Co-operation of the Ohio Electric Light Association, will be held at the Hotel Hollenden on Wednesday, January 20, 1915, at Cleveland. The meeting will start promptly at 10 o'clock with an address of welcome by Mathias Turner of Cleveland Electric Illuminating Company. This will be followed by an illustrated paper by T. E. Simpers of the Westinghouse Electric & Manufacturing Company on "Applications of Electric Drive in Flour Mills." Luncheon will be held at 12:15 p. m., following which the delegates will be addressed by a prominent man of Cleveland.

The afternoon session will come to order at 2 p. m. with a paper by W. A. Wadsworth of the Union Gas & Electric Company of Cincinnati on "Securing Business with the Nitrogen Lamps." This will be followed by an illustrated paper by a representative of the General Electric Company on "Applications of Motors up to 25 Horsepower," following which J. C. Matthieu, power engineer of The Dayton Power & Light Company will present a paper entitled "Applications of Industrial Trucks."

A cordial invitation is extended to the representatives of all electric light and power companies, electric manufacturers etc., in Ohio and in the neighboring states to attend this meeting.

Good Lighting Campaign Among Pupils.

A lecture on "Lighting for Sight-Saving" was recently given before the pupils of the Washington Irving High School, by Mrs. C. B. Lyman. In connection with this address, exhibits showing good and bad lighting both by gas and electricity, were arranged in the exhibition hall outside of the Auditorium.

The electrical exhibit was provided by the New York Edison Company. In addition to the lamps and fixtures, the pupils were shown photographs illustrating the points of correct and incorrect illumination, and literature on the same subject was distributed, including more than 500 copies of the Lighting Primer of the Illuminating Engineering Society.

Electric Vehicle Data

Electric-Vehicle Practice in Europe.

E. W. Lloyd, general contract agent of the Commonwealth Edison Company, Chicago, spoke before the Chicago Section, Electric Vehicle Association of America on January 5, choosing for his subject, "Battery Maintenance Systems and What We Can Learn From European Experience." He referred first to the successful operation of storage-battery cars on many of the branch railroads in Germany and the possibilities in this direction.

In Berlin electric taxicabs are widely used and have proven very successful. This is due mainly to the battery maintenance system, in vogue there, permitting the interchange of a discharged battery for a charged one whenever necessary. Battery maintenance is taken care of by separate companies from those owning the vehicles. Rates are made on a mileage basis, a careful record being kept by the maintenance company of the operation of each vehicle equipped.

Lantern slides of the equipment were shown. Mr. Lloyd believes that this practice can be emulated in this country when business conditions improve. In the discussion he called attention to the willingness of the Edison company to co-operate with other interests in the promotion of the electric vehicle and thought that some definite plan of co-operation could be worked out.

Harry Salvat stated that there was an indication that electric garage owners would offer service to gasoline owners on the same basis as to electric owners unless greater co-operation was received from vehicle manufacturers.

In its campaign to bring the merits of electric vehicles to the attention of prospective users, the Electric Vehicle Association of America uses the following pertinent arguments:

All of its critical parts are the product of the large national electric apparatus manufacturers and are therefore well developed and made of the highest type of workmanship and material.

Electric vehicle design has been standardized for the past twelve years, no radical changes have been necessary, although minor improvements have been constantly made.

Other commercial types of motor vehicles have been under development for less than half this period and exist in great variety of design with little semblance of standardization.

A number of large installations of electric vehicles have been in continuous and successful operation for over ten years. A remarkable number of large installations have been put into operation during the past five years.

No correspondingly large installations of other types of commercial vehicles exist. This indicates the stability and economy of the electric type.

The purchasers of these large installations have been most conservative business organizations and those to whom reliability of transportation equipment has been of vital importance.

Express companies have invested several million dollars in electric vehicle equipment and this type constitutes the majority of the motor vehicle equipment of such companies.

It is conceded by all users of mixed equipments that the electric is considerably cheaper in operating cost than any other type, by reason of its simplicity, fewer parts, ease of control and the standardization of its renewable wearing equipment. No skilled labor is necessary for its operation.

These arguments are being specially directed to post-office officials.

GENERAL.

Name of Company—Geo. S. Connelly Company, Springfield, Ill.
Business—Retail Grocers, Butchers, and Bakers.

Capacity of Vehicle—1,000 Lbs.	Are Tires Solid, Pneumatic or Cushion?—Solid.
Date of Purchase—Sept. 5, 1913.	Make of Battery—Edison.
Approximate Price—$2,500	Type of Cells—A-4.
Make of Vehicle—Argo.	Number of Cells—60.
Make of Tires—Motz.	
Size of Tires—36x3.	

OPERATING DATA.

Average Daily Mileage—27.	Cost of Storage and Washing per Month—Car washed by driver. Stored in rear of store.
Daily Hours in Use—8.	
Kilowatt-hours per Month—338.	
Days in Service, per Month—28.	Driver's Salary per Month—$40.
Cost of Electric Power per Month $7.50.	Cost of Repairs and Renewals for 12 months—$50.00

TOTAL AVERAGE MONTHLY OPERATING COST—$90.40.

Electrical Construction

METHODS OF MOUNTING MOTORS AT CEILINGS.

By Ralph G. Bradshaw.

It very often occurs that the most desirable location for a motor for a group drive is at or near the ceiling of the room. In such a location the motor does not occupy valuable floor space, and is immune from meddling by the unauthorized. There are two possible objections to such a location. One is that the space near the ceiling is always the hottest part of the room, which is undesirable, because a motor placed in such a location may become unduly overheated. The other objection is that unless proper provisions are made, a motor near a ceiling may be difficult to inspect and repair. The last objection can be nullified, provided proper ladders and platforms are installed from whch the inspector can work.

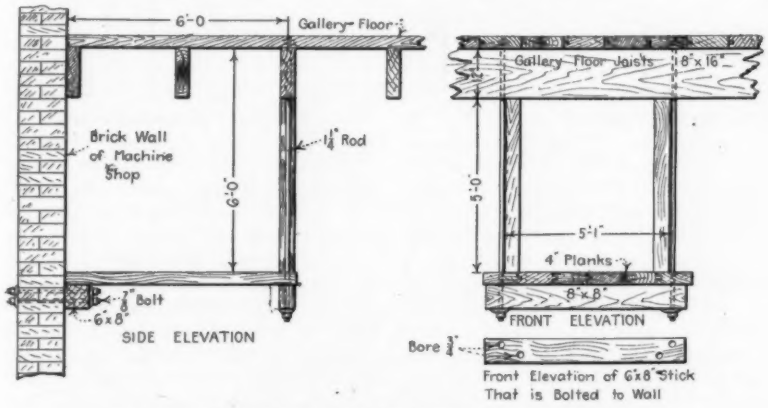


Fig. 1.—Motor Shelf Supported From Ceiling and Wall.

Where a small motor is to be placed it can be bolted, inverted, directly against the ceiling. Timbers can be secured against the ceiling into which lag bolts, passing through the bolt holes in the motor frame, can turn. Lag bolts should, however, never be used to support a motor; hence the preferable and only dependable method of supporting a motor directly to a ceiling is to arrange the supporting bolts so that they will pass entirely through the floor. The most effective way to raise an inverted motor to a position against the ceiling is to thread two lines or falls through diagonally opposite holes bored through the ceiling as above suggested. In boring these holes care must be taken to place them so that they will exactly fit over the holes in the motor frame. The lines are passed through from the story above to the floor of the room below. The motor to be mounted is turned upside down on the floor and each of the two lines is threaded through a bolt hole in the motor frame corresponding in position to the hole in the ceiling above through which the line passes. Then a knot is tied in the line below the motor frame so that when the lines are pulled on the knots will sustain the weight of the motor. Then helpers on the story above pull on the lines and draw the motor in position against the ceiling. Bolts are inserted through the remaining holes in the floor and through the motor bed plate and the nuts are set up on these bolts, holding the bed plate firmly in position. Then the lines are removed and supporting bolts are pushed through the holes in the floor from which the lines have been taken and through the motor bed plate, and their nuts turned up on them.

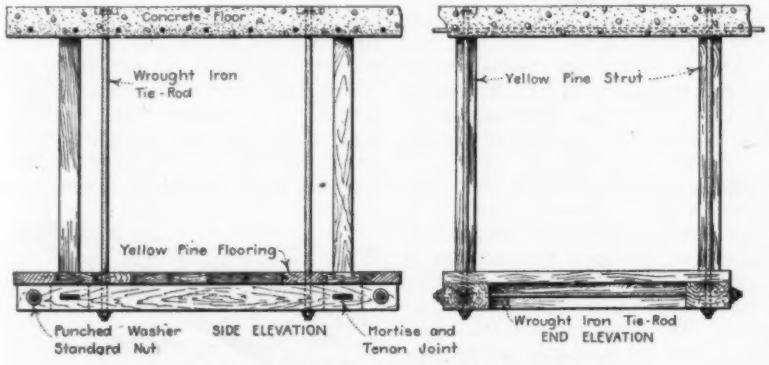


Fig. 2.—Motor Shelf Supported From Concrete Ceiling.

With larger motors it is necessary to build a shelf or platform upon which

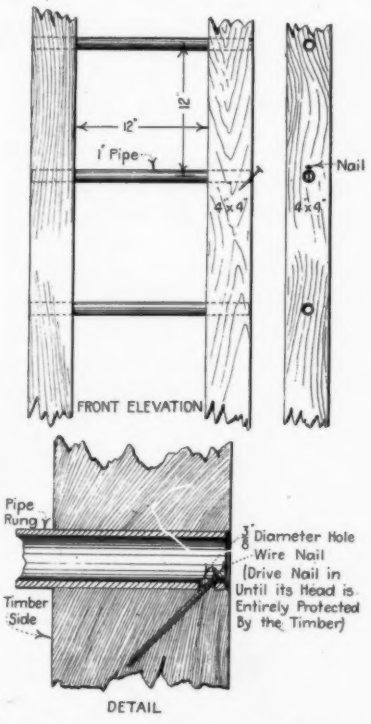


Fig. 3.—Construction of a Ladder with Pipe Rungs.

the motor may rest and upon which the inspector may stand while cleaning and adjusting the machine. Fig. 1 shows a simple motor platform that has been found very satisfactory in practice. A number of supports similar to this were used in the Omaha shops of the Union Pacific Railway. Group-drive motors of outputs in the neighborhood of 20 horsepower were mounted on the platforms. It will be noted (Fig. 1.) that all of the platforms were arranged along the side of the building, so that a 6-by-8 timber held to the brick wall with seven-eighths-inch bolts formed a support for one edge of the platform. An 8-by-8 timber formed a beam carrying the outer edge of the platform. This timber was in each case held from the floor by two 1.25-inch tie-rods that passed vertically entirely through 8-by-16 floor joists. Care was taken to so locate the motor platforms that the tie-rods would in every case pass through holes in the floor joists, because the holes in the joists in which the tie-rods snugly fitted provided lateral support for the platform structure and tended to minimize vibration. A 6-by-8 strut was clamped in at the side of each tie-rod between the platform floor and the gallery floor joists. A slot was cut in the side of each of these struts for the accommodation of the tie-rod which maintained each strut in its correct position.

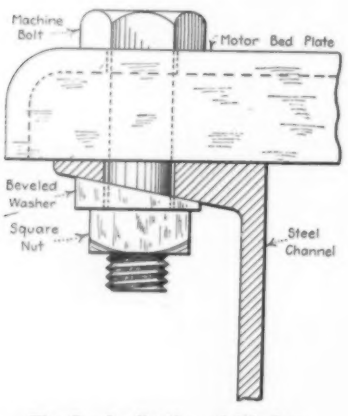


Fig. 5.—Application of Washer.

A platform that has been successfully used for supporting motors to ceilings in reinforced-concrete buildbuildings is shown in Fig. 2. The tie-rods pass, as they should in every case, entirely through the floor, so that they will be substantially supported from above. The timbers comprising the frame upon which the floor is laid are mortised and tenoned and are held together with iron tie-rods, eliminating any possibility of the shaking asunder of the frame. Where there is a considerable side pull occasioned by a belt drive from a motor platform, it may be necessary to install braces for a platform like that shown in Fig. 2, to prevent the platform from being pulled out of its position laterally. Ordinarily, however, such braces are not necessary if the platform is well constructed and the nuts of the tie-rods are set up snugly.

It is, however, essential that a good ladder, or some other means of access, be provided to every motor platform. If it is difficult for the inspector to reach the platform, the motor will probably not receive the attention that it should. A splendid form of ladder that will not wear out, and that can be readily constructed is shown in Fig. 3. The side pieces are 4-by-4 timbers and the rungs are 20-inch lengths of one-inch pipe. Pipe that cannot be used for any other purpose, or because it is rusted or cracked, can be utilized for rungs of a ladder of this type. The 12-inch distance between centers of rungs provides convenient spacing, but this can be increased or decreased in accordance with the practice prevailing in the plant where the ladder is installed. The holes through the 4-by-4 timbers for the reception of the pipe should be so bored that the pipe will fit into them very snugly, and a nail should be driven as shown in the detail in Fig. 3, through a hole in the end of each pipe to prevent its turning as a man mounts the ladder. The nails also keep the rungs from slipping sideways out of the timbers. The nails should always be driven in far enough so that they will not extend and cut the fingers of a man using the ladder.

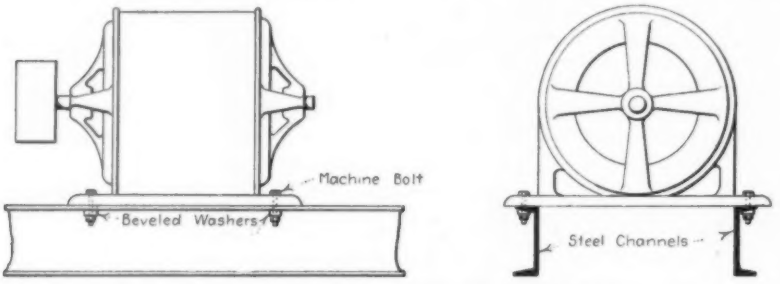


Fig. 4.—Small Motor Clamped With Beveled Washers.

TABLE I.—DIMENSIONS OF CAST-IRON BEVELED WASHERS FOR I-BEAMS AND CHANNELS (IN INCHES).

Size of Bolt	Diameter of Hole	Width, Length	Thin Edge	Thickness at Center	Thick Edge	Smallest Beam on Which It May Be Used	
	D	E	F	G	H	Chan-nel	I-Beam
½	⅝	1⅛	⅛	⅜	½	4	6
⅝	¾	1¼	⅛	⅜	½	6	7
¾	⅞	1½	⅛	⅜	½	7	9

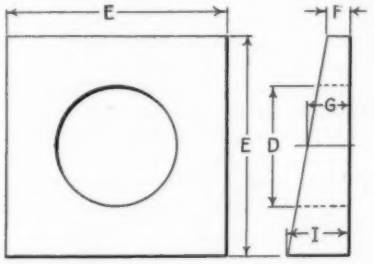


Fig. 6.—Details of Beveled Washer.

Ordinarily ladders about an industrial plant are made with 2-by-4 vertical timbers, and 1-by-4 rungs, and such are of course cheaper, in first cost at any rate, than the ladder in Fig. 3, but the rungs in wooden ladders wear out, and some times they break and injure a man and thereby involve a damage suit. It is for the reason that the pipe-rung ladder is always safe and will practically never wear out that it is probably more economical in the long run than a wooden ladder. The pipe rungs can be cut and drilled in the pipe shop at times when the mechanics have no other work to do.

In modern plants the practice of using structural steel for supporting motors is every day becoming more popular. In some shops wood construction, and in fact any construction that is combustible, is not permitted.

Structural steel is used instead and provides a permanent, rigid, and fireproof frame for the motor platforms. Small motors can be conveniently mounted on a couple of channels as suggested in Fig. 4. The holding-down bolts of the motor pass through holes in the channel flanges and are held therein by nuts turned on at the lower ends of the bolts. Inasmuch as the sloping surfaces of channels and I-beams always slant with a 6-to-1 pitch, it is necessary to insert so-called beveled washers between the holding-

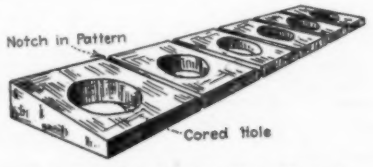


Fig. 7.—Method of Casting Channel Washer.

TABLE II.—DIMENSIONS OF CAST-IRON CHANNEL-WASHERS.

Size of Channel	Diameter Bolt Hole A	Width of Channel Slot B	Length Overall C	Width Overall D	E	F	G	H	I
3 by 4 3 by 5	⅝	1⅛	4⅝	2	1½	7/16	⅝	¼	¼
4 by 5.25	⅞	1⅝	5	3	2	½	¾	¼	¼
3 by 6	11/16	1⅝	5½	2¼	1⅜	⅝	1½	5/16	5/16
	⅞	1⅝	7¼	3	2	½	3	¼	¼
4 by 6.25 4 by 7.25 5 by 6.5	⅝	1¾	5	2	1½	7/16	⅝	¼	¼
5 by 9	1	2	6	4	2½	½	1	¼	¼
6 by 8	⅞	2	8⅝	4	2¼	½	3⅝	¼	¼
5 by 11.5	1⅛	2 1/16	8	4½	2¾	½	2⅞	¼	¼
6 by 10.5	1⅛	2 1/16	9¼	4½	2¾	7/16	4	¼	¼
7 by 14.75 8 by 11.25 8 by 13.75	1⅛	2⅜	8¾	4½	2¾	7/16	2⅞	¼	¼
8 by 18.75 9 by 20 10 by 15	1¼	2 1/16	13½	5	4	⅝	6⅞	⅛	¼
9 by 20 10 by 15	1¼	2¾	10¾	4½	2¾	⅝	4	¼	¼

down-bolt nut and the flange face as shown in Fig. 5, so that the nut will have a horizontal surface upon which to bear. Fig. 6, in connection with Table I, shows dimensions of beveled washers for use with I-beams and channels that have been found satisfactory in practice. It is not usually possible, so far as the writer is aware, to obtain these beveled washers on the open market. They can sometimes be secured from the structural-steel companies, but if many are to be used it will pay any concern to make a pattern like that shown in Fig. 7 and have the washers cast at the nearest foundry. It will be noted that in the pattern of Fig. 7 a deep groove is cut between adjacent washers. A strip of a half dozen or more washers is cast from one pattern and then the washers can be broken off along the grooves as they are required.

With larger motors, it is not feasible or desirable to bolt them directly to the flanges of steel sections as shown in Fig. 4. The disadvantage of this method is that the holes must be drilled accurately in the channel or I-beam flanges for the accommodation of the holding-down bolts, and furthermore that after the holes have been drilled only one position of the motor is possible. The arrangement of Fig. 8, wherein cast-iron channel washers, Fig. 9, are used for clamping the structural-steel members together, eliminates both of these disadvantages. No drilling is required in the channels that comprise the supporting frame, and the character of the construction is such that the motor can be readily shifted along the two channels upon which it rests, and these two channels can in turn be shifted along the members upon which they rest, so that the motor can be readily alined with the pulley which it is to drive.

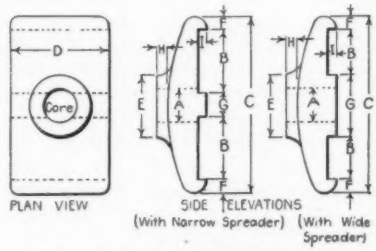


Fig. 9.—Cast-Iron Channel Washer.

As suggested in Fig. 8 two channels are always used to form a supporting beam where the channel washers are utilized. The channel washer has two functions. The first is that it provides a means of clamping the two channels that fit into it to some other member, and the second function is that it maintains these two channels at a given distance from one another. The projection *G* in Fig. 9 maintains the channels at a given distance apart. It is seldom possible to obtain these channel washers on the open market, and for this reason Table II is given to show some dimensions that have proven satisfactory in practice. These channel washers can be used for other sizes of sections than those shown in the first column of the table, and also in combination with small I-beams.

No floor is shown in the motor platform in Fig. 8 because practice differs in regard to floors on structural-steel motor supports. Some concerns insist rigidly upon the elimination of wood, in which case floors of standard checkered steel plate can be used. Such floors are, however, of necessity always grounded on the structural-steel frame of the building. A man standing on such a floor is therefore liable to receive a severe shock. It is for this reason that it is probably usually the best practice to place a wooden floor on a steel platform around the motor.

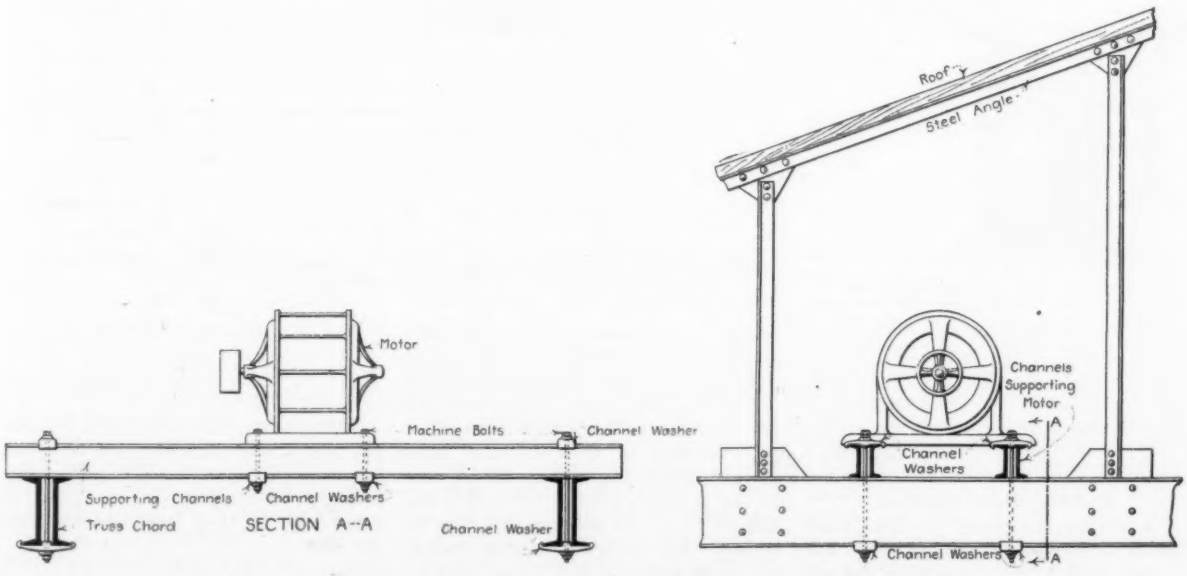


Fig. 8.—Motor Mounted on Channels and Clamped to Structural-Steel Roof Truss.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Greased Cloth for Long Runs.

In fishing wire through long runs of pipe with four or five bends in it, it is sometimes hard to pull it through. I find it advantageous to wrap a piece of cloth tightly around the wires for about three inches, starting at the hook, and fastening it to the hook so that it cannot slip. This cloth is greased and the wires then come through easily.

Edward Kemp.

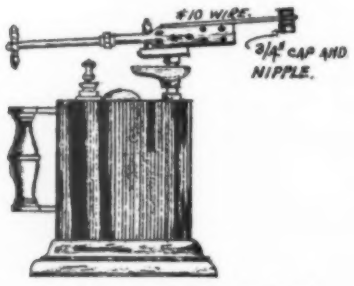
File Brush for Cleaning Cable.

When making a tap joint to a main cable, I hit upon the idea of using a file brush to clean the cable. Moving the file brush lengthwise and spirally, following the strands, it effectually removed all insulating material from between the strands.

Homer R. Long.

Soldering Ceiling Joints.

For soldering ceiling joints I use a cup which is mounted on the torch, as shown in the accompanying illustration. The cup is made of a three-quarter-inch cap and a three-quarter-inch nipple, three-quarter inch long. After fastening these together a piece of No. 10 wire is twisted around the nipple, and fastened to the torch.



Soldering Cup Mounted on Torch.

W. W. Schnohr.

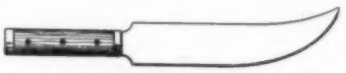
Bending Metal Molding.

It is often necessary to make small bends or offsets in metal molding, and to accomplish this I assemble the two parts and make the necessary bend with the parts together, usually making the bend over my knee. Then I separate the parts and have them both bent to the same shape so they will fit together again without any trouble.

Elmer J. Smith.

Knife For Floor Boards.

It is a very difficult job to remove a board from a matched hardwood floor, or a piece of matched sheathing from a side wall, without splitting it. I had a job to do some time ago where it was necessary to do both. I got a



Knife for Floor Boards.

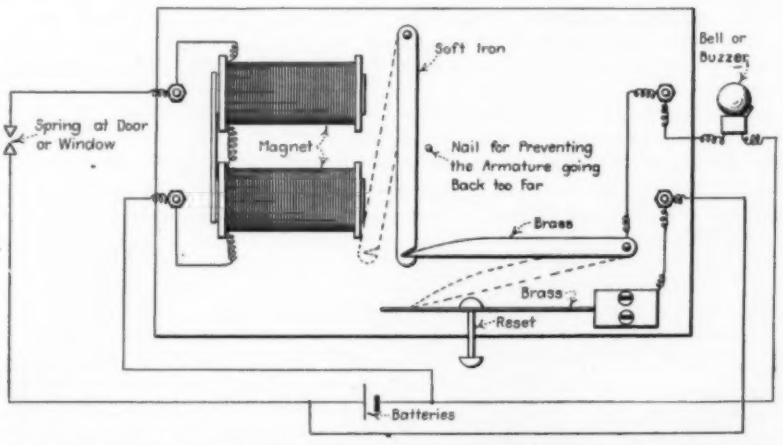
cheap knife as shown in illustration. By inserting this knife in the crack between the floor boards and hammering on it the tongue of the board can be cut off and the board raised without much difficulty. Occasionally one will strike a nail, but these can be avoided after the first two or three, as one can judge the distance they are apart.

In the case of the sheathing, the knife should be inserted at the top and the tongue split off on both sides.

E. W. Dullea.

Burglar Alarm.

The accompanying diagram shows a simple arrangement for a burglar-alarm system, where it is desired to have the bell ring constantly after the circuit has once been closed, until the bell is reset. The dotted lines show the positions of armature and brass drop after the circuit has been closed at the spring. Closing the spring circuit actuates the magnet and this results in closing the bell circuit through the same battery.



Wiring Diagram for Burglar Alarm which Continues Ringing After Original Contact Spring is Released.

William Reschke.

Service Entrance in Small Space.

In wiring old detached houses, where the houses are so close together that it would be impossible to make a gooseneck bend for the entrance service pipe, I use a condulet L fitting and a short nipple from the fitting to the cutout cabinet in the basement. Sometimes there is not more than a foot between houses, so that something of the kind is necessary.

E. Quarnstrom.

Substitute for Reducing Bushing.

In reducing the size of conduits from three-quarter-inch to half-inch, reducing bushings or sockets are not always handy. A standard three-quarter-inch die will thread a half-inch coupling so it will make a neat substitute for a three-quarter-inch by half-inch reducing bushing.

Ben R. Browne.

Determining Polarity.[1]

A simple method for determining the polarity of a circuit, having the added advantage that it does not require any particular preparation, is as follows.

Tear off a piece of blueprint paper (about an inch square will do for 110- and 220-volt circuits) and wet it. Place the two terminals of the circuit about a quarter inch apart on a 110-volt circuit and a trifle more on 220 volts. The paper around the negative lead will turn white. A lamp can be placed in series with one of the leads to avoid a short-circuit.

Blueprints are usually available on a job, but I have seen wiremen who had frequent occasion to determine the polarity of circuits, carry strips of blueprints in their tool-kits for this purpose.

P. Justus.

1 From *Power*.

Public Service Commissions

Conducted by William J. Norton

NEW YORK—Second District.

The Rockland Light and Power Company was authorized to use the net proceeds from the sale of $100,000 of its 5-per-cent mortgage bonds approved in August, 1911, for financing extensive improvements to its system and for the purchase of land and rights of way.

OHIO.

The Dayton Power and Light Company was authorized to purchase all the property of the Cedarville Light and Power Company, comprising electric light, heating and power plants, located in the villages of Cedarville, Clifton, and Yellow Springs, Ohio, for a consideration of $20,000.

PENNSYLVANIA.

Walter H. Gaither has been appointed by Governor Tener as member of the Public Service Commission. Samuel W. Pennypacker was named as chairman of the Commission, to succeed the late Nathaniel Ewing and was given the Ewing term, which adds two years to the time he will serve. The other commissioners are advanced a year, and Mr. Gaither was given the seventh place. The changes are to be sent to the Senate for confirmation. Mr. Gaither has resigned as private secretary to the Governor, and also as secretary of the Executive Committee of the Panama Exposition Commission. He served as private secretary to Governor Tener throughout his term as congressman and during his administration as chief executive of the state.

WISCONSIN.

Waterloo Municipal Waterworks and Electric Light Plant. Complaints were entered as to the rates and service of the electric and water utilities of the Village of Waterloo, and the Commission on its own motion instituted a general investigation.

An examination of the books and accounts of the utilities disclosed that the inadequacy and incorrectness of the records were due chiefly to the lack of a scientific accounting system. An accounting system was prescribed, and the new system was installed by a representative of the Commission.

The village is ordered to purchase the electric meters now owned by consumers.

In regard to the rates for electric service the Commission says: "The present rate for commercial lighting is 12 cents per kilowatt-hour for the first 50 kilowatt-hours and 10 cents per kilowatt-hour for all over 50 kilowatt-hours. The manner in which this rate has been applied has made it regressive, and hence objectionable. For instance, if a consumer used 50 kilowatt-hours he would pay $6.00, but if he used 51 kilowatt-hours he would pay $5.10. By taking a little more current he would save 90 cents. The rate for power is also regressive. . . . In order to correct the discriminatory features of the present system of charges it is necessary to change the type of schedule. The question of the particular kind of rate schedule that should be adopted was submitted to the members of the village commission. After going over the matter quite thoroughly with us they decided that a rate similar to the one usually prescribed by this Commission would be satisfactory."

The Commission prescribed a rate for commercial lighting of 12 cents net for the first 30 hours' use per month of active load, 10 cents net for the next 60 hours' use per month of active load, and 8 cents net for all excess use.

The power schedule provides a demand charge of 50 cents per month for the first horsepower or fraction thereof, and 50 cents for each additional horsepower of connected load; plus an energy charge of 7 cents net per kilowatt-hour for the first 50 kilowatt-hours scaled down to 2 cents net per kilowatt-hour for all over 10,000 kilowatt-hours. These power rates are subject to the following "limiting rates." The maximum rate for power is not to exceed 10 cents per kilowatt-hour, and the minimum monthly bill is not to be less than $1.00 for the first horsepower or fraction thereof, and 25 cents for each additional horsepower of connected load.

In regard to the power rates, the Commission says: "The power rate which we are prescribing is somewhat higher than the old rate. This is particularly true for the plant's largest customer. In making an adjustment in the rate schedule of a utility, increasing the rate to large power consumers is a serious matter, because there is always the likelihood of such customers finding it advantageous to use some other source of power. In the instant case we have given this matter careful consideration, and we believe that the rate prescribed is low enough to retain the business that the utility now has, and at the same time is high enough to pay the additional costs involved in furnishing the service.

"In addition to the regular power schedule it is necessary to fix a rate for emergency service, and also one for service furnished to customers who operate only a relatively short time each year. As yet no emergency service is being supplied, but a demand for it may arise in the near future, in which event it will be necessary to have such a rate. The rate usually established for this kind of service is similar to the regular power rate, with the exception that the limiting rate does not apply, that is, the rate would be 50 cents per horsepower per month plus the regular charge for whatever energy is used. There seems to be nothing in this case which would make a departure from the usual practice either necessary or advisable. The rate outlined above will accordingly be prescribed for emergency service.

"In establishing a rate for customers who take energy only a short time each year, the same difficulty is encountered as is met with in making rates for large power users, who can readily find some other souce of power. If this short-time service can be supplied without increasing the capacity of the station or without making any investment other than stringing the regular service wire, it may be a source of considerable profit. In this connection, though, it should be borne in mind that every plant should have some reserve capacity, and that short-time business of this nature should not be taken on if it only makes use of this reserve capacity, because if this is done it may become necessary to increase the size of the units in the station at some later time. In other words, this kind of business should come off the daily peak if it is supplied during the winter months, or it should come during the summer time when the daily peak is comparatively small. The operating condition of each plant must, of course, determine in each instance the proper course to pursue. The reason no new investment should be made for this kind of business, even though it could be had at the regular rates, is

at once obvious. The regular rates are based on the assumption that the investment will be used twelve months of the year, and there is, therefore, a larger area, so to speak, over which the fixed charges can be spread. In this case it seems that a straight rate of 12 cents per kilowatt-hour would be reasonable both to the customers and to the utility."

The Lancaster Light & Power Company was given authority to purchase the property of the Lancaster Electric Light Company for a consideration of $34,371.36.

The New Richmond Power Company was authorized to issue $10,000 of stock to provide for future extensions and for the payment of indebtedness incurred in making several past extensions.

Marion and Northern Telephone Company. The Commission issued an order, rendered December 31, 1914, revising the rate schedule of the Marion and Northern Telephone Company. A valuation of the Company's property was made. The decision says:

"In determining a fair value upon which to allow a rate of return it is only fair to take into consideration an allowance for going value and the fact that the accumulated surplus and reserves have been reinvested in property and plant. With a present value of $18,504 it seems adequate if a return is allowed on a property value of approximately $23,000."

The total operating expenses included an allowance of seven per cent on the reproduction cost for depreciation, and seven per cent on the investment for rate of return.

In regard to the company's rules and regulations the Commission says: "The policy of collecting rentals monthly in advance is a legitimate practice, which the applicant is authorized to continue. For failure to pay rental and tolls within 15 days after due a penalty of 10 cents per telephone will be allowed."

Panama Canal Flag to be Unfurled Electrically.

The American flag to be unfurled at the official opening of the Panama Canal will be made in the Betsey Ross House in Philadelphia. Each star will be supplied by the governor of a state, and the executive committee of the Bi-Centennial Association will ask President Wilson to release the flag by pressing an electric button in Washington.

Decrease in Ohio Coal Mining.

Twenty millions tons is the Geological Survey's estimate for the coal production of Ohio during 1914.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 240.—Life of Gas-Filled Tungsten Lamps.—What is the longest life record as yet attained on test or in service with the new nitrogen-filled tungsten lamps?—P. C. U., Springfield, O.

No. 259—Relative Cost of Manual and Automatic Telephony.—What is the relative first cost of manual, central-energy exchange and substation equipment for, say, 10,000 telephone lines and of full-automatic equipment for the same number of lines? What is the relative operating and maintenance cost of the two systems? Does the reduction in operating cost of automatic equipment offset the increase in fixed charges?—H. L. F., Buffalo, N. Y.

No. 260.—Promiscuous Use of Pull Chains.—Is the promiscuous use of pull-chain sockets controlled by long chains or cords permitted by electrical inspectors in general? I have come across many cases where this scheme is used to control stairway lights, bedroom ceiling lights, vestibule and porch lights, etc., in most cases to avoid using three-way or ordinary wall switches. Even with short pull chains I have found shades and reflectors loosened and fixtures strained and wondered whether this growing practice is looked on with favor.—C. T. P., New York, N. Y.

No. 261.—Dynamic Braking.—In the case of direct-current hoist motors it is possible to effect dynamic braking by a control system that connects the starting resistance as a shunt to the armature when stopping the motor. Has any similar scheme been worked out for polyphase alternating-current hoist motors?—D. B. L., Warren, O.

No. 262.—Electrically Driven Street Sweeper.—Has any electrically driven suction street sweeper ever been tried out by any municipality or street-car company?—F. N. S., Toronto, Canada.

Answers.

No. 255.—Automatic Cutout for Series-Multiple Lamps.—Is there any way of arranging one or more switches and fuses on a 440-volt circuit so that when there are four 110-volt lamps connected in series one may burn out without affecting the other lamps? Are there any devices on the market and approved by the Underwriters for preventing all the lamps on such a circuit from going out when one burns out, or is there any way of overcoming this difficulty? If there is any way, please show the arrangement by a diagram.—V. J. L. N., New York, N. Y.

In the case of an alternating-current circuit, each of the lamps can be provided with a reactance shunt or compensator. This coil has just sufficient reactance to cause most of the current to pass through the lamps. If, however, a lamp burns out the coil will pass the current at a slight increase in drop over the lamp alone. This method has long been used for series incandescent street-lighting circuits and such reactances can readily be bought. If the source is alternating, a still better plan is to use a small transformer to reduce the potential at the lamps to 110 volts and then run them in parallel.—H. E. W., Chicago, Ill.

Multiple lamps of standard 110-volt rating may be operated on alternating current from a set of uniformly arranged taps on a balance coil or auto-transformer. Turning one lamp on or off has no effect on the others. Multiple lamps to operate in series on direct current are made with a special resistance, which is automatically switched into circuit in place of the arc when the carbons are consumed or go out. One lamp at a time cannot be turned out without inserting in the circuit a resistance to keep the current normal in the remaining lamps.—W. P. H., East Pittsburgh, Pa.

No. 257.—Heating of Generator Bearings.—I have heard of considerable trouble in the case of large alternating-current generators due to heating of bearings, which is supposed to be caused by an electromotive force generated in the shaft of the machine setting up a current circulating through the bearings and baseplate. Is this the true explanation? How is this trouble overcome?—P. N. L., Norwood, O.

It has long been known that under certain conditions a voltage may be induced in the shafts of electrical machines. These induced voltages give rise to currents which may be, and frequently are, of considerable magnitude. While these induced voltages are very small, rarely exceeding a few volts, the current may be heavy due to the large cross-section offered to the flow of current through the bearings, pedestals and bedplate of the machine. Although these currents are known to exist, and means for reducing their destructive effect are often employed, the reasons for their existence are not generally understood. Nor do these currents readily permit of calculation on account of the variable factors which necessarily enter such a problem.

Bearing currents may be induced in either direct-current or alternating-current machines. In the direct-current type of machine an electromotive force

will, of course, be induced only while the machine is rotating; whereas with alternating-current machines a voltage will be generated whether the machine is stationary or revolving. In fact with alternating-current machines the current flowing will in all likelihood be greater at standstill than when the machine is rotating, because the resistance offered to the flow of current between shaft and bearings will be at its lowest on account of the comparative absence of the film of oil.

The flow of current along the shafts of machines results from dissymmetry of the magnetic conditions of the machine, and may be in either the armature magnetic circuit or the field magnetic circuit or both. Mechanical joints are the chief cause of magnetic dissymmetry; while great differences of permeability and length of flux path are also other causes.

Under such conditions, that is, when the magnetic circuit is unsymmetrical, the generator shaft is somewhat equivalent to a single turn of a magneto-electric generator.

Very often the currents flowing along the shafts of machines are quite large, though the electromotive force is small, because the path provided by the bearings, pedestals and bedplate of the machine has a low resistance due to its large cross-section. The calculation of these currents is, however, generally out of the question, as it is not possible to predetermine the various values of permeability of the flux path, the reluctance of the joints, resistance of oil film, of the castings, etc. It may be said generally that the larger the machine, in both capacity and size, the more likely are bearing currents to appear. Large water-wheel-type generators are particularly prone to this phenomenon. Bearing currents occur not in direct-current and synchronous machines alone, but in asynchonous machines, such as induction motors, as well; in fact such machines may have very heavy currents flowing, as the small air-gap of these machines tends to augment the effect of an unsymmetrical magnetic circuit.

When the currents circulating along the shafts through the bearings reach serious proportions it is customary to do either of two things; namely, short-circuit the shaft upon itself or insulate the shaft from the bedplate of the machine. The first of these is accomplished by installing brushes on the ends of the shaft and joining them through cable of sufficient size to carry the current with ease. The cable may or may not be insulated from the machine frame, it being a matter of individual opinion. Of course, under these conditions the frame of the machine is at all times in shunt to the cable and will continue to offer a path to a certain proportion of the total current. Insulating the cable from the frame of the machine will tend to further lessen the current taken through the machine frame. Interposing an insulating joint in the circuit is the most usual and generally the most satisfactory way of eliminating the current. Once done, if done properly, it can be forgotten, whereas the brushes required for picking up the current at the ends of the shaft in the method outlined above need fairly frequent attention.

In a general way it may be said that there is little trouble experienced from currents induced in the shafts of electrical machines. It has already been pointed out that the larger the machine the more pronounced this phenomenon tends to become. I believe that the passage of current between bearing and shaft becomes harmful only when of a density of about one ampere per square inch of contact surface is reached. From this it can at once be seen that even on large machines the current must be very heavy indeed before it would do very much damage.—Ivor L. Kentish-Rankin, Chicago, Ill.

It is possible for the bearings of a large alternating-current generator or motor to become heated from a current circulating from one bearing to the other through the rotor shaft and bedplate. The electromotive force which causes this current is set up in the pedestals of the machine and is created by stray magnetic fields. The current is an alternating one.

However, this current in bearings is noticeable only on the larger machines and seldom gives trouble. The marking of the shaft by the oil rings is an indication of current in bearings. It is best to test for this, however, with an ammeter or low-reading voltmeter. One of the largest manufacturers uses the simple and convenient method of completing the circuit from pillow block to shaft through an alternating-current ammeter and a heavy copper cable of about 500,000 circular mils. If the current should be large enough to cause trouble, either the bearing or pillow block should be insulated by an insulating plate.—R. E. H., Midlothian, Tex.

No. 258.—Smashing Point of Storage Battery.—Is there a definite and well established point in the life of a storage battery at which it becomes economical to scrap the old, depreciated plates and purchase a new element, that is, a point corresponding to the smashing point of incandescent lamps?—B. E., Newark, N. J.

The smashing point of an incandescent lamp is reached when the operating cost exceeds the interest and depreciation charges on the new lamp, in other words, where the additional cost of operating can be more than compensated for by the gain in efficiency of the new lamp.

Let us see whether there is such a point in the life of the storage battery. Assuming the plates to be kept in good condition, as the battery grows older the active material will gradually fall off and the plates will wear thinner and thinner. In this case, however, the efficiency of output to input does not decrease, but, if anything, increases due to the formation of active material by the grids themselves. Of course, sediment will deposit on the bottom of the jars, which must be cleaned out regularly. As this wearing away continues, after a while holes will actually be eaten through the center of the meshes (assuming a pasted type of plate), and the battery will decrease accordingly in capacity. A point will finally be reached where the battery will not have sufficient capacity to perform the work for which it is needed, and at that point, allowing a fair margin of safety, the plates must obviously be scrapped. Before this point is reached, however, if a rather high duty is expected of the battery, the effect would be the same on the thinner plates as though a heavier duty had been imposed on the original battery and the apparent capacity may be even less than the foregoing statement would indicate. To cite a concrete example: A battery originally furnished 10 amperes for 8 hours. This same battery, when old, might be able to supply these 10 amperes for only 4 hours.

To come back to the incandescent-lamp comparison, we find that at the end of its useful life the operating cost is large compared with the renewal cost. With the storage battery, however, the renewal cost is nearly equal to that of the operating cost, and from this point of view, as well as from the other, it will appear that there is no distinct smashing point and that the plates can be used with economy as long as they will do the work required. There is only one condition apparent under which this would not be true, namely where there is a fixed charge for recharging; in this case the cost of recharging the plates of diminished capacity might more than overbalance the fixed charges on new plates.—V. A. C., Cleveland, O.

Good Business in Boston.

Evidences of exceptionally good business conditions in Greater Boston are found in the record output of electricity by the Boston Edison Company for Christmas week. The output for the week December 19 to 25 was about seven per cent greater than on the corresponding week last year. The highest peak of load was 65,342 kilowatts, which is 5.1 per cent ahead of any day last year.

The greatest daily output was 770,000 kilowatt-hours, on Monday, December 21. New business contracted for in 1914 exceeded that of 1913 by 25 per cent.

LETTERS TO THE EDITOR.

Value of Service and Cost of Service In Rate-Making.

To the Editor:

You begin an editorial in the December 12 issue with these words: "There has been considerable difference of opinion and misunderstanding relative to the 1914 report of the Rate Research Committee of the National Electric Light Association, in which 'value of the service' as a factor in rate-making was recommended," etc.

There certainly is a difference of opinion concerning the validity of such a basis for rate-making, but I doubt whether this difference of opinion is due to a misunderstanding of the section of the Rate Research Committee report which reads:

"The committee has further come to the conclusion that these results can best be obtained by adjusting the various rates to the value of the service rendered, giving proper consideration also to the relative costs of service, and defining value of the service rendered as the amount which the user would have to pay for the same or equivalent service under absolutely fair but not destructive competition; in other words the amount at which the user could serve himself or provide an equivalent or substitute means of service under free but not destructive competition."

This section contains three apparent elements or bases of rate-making, but in reality only two. The three apparent elements are:

(1) The cost of service.

(2) Cost of service as determined by free competition.

(3) Value of service, or what the customer is willing to pay.

Under absolutely free competition, elements one and two, as classified above, will tend to produce the same rate. If they do not, the freedom of the competition will become subject to suspicion. Element three is the one that has provoked criticism, not because anyone thinks it is new, but because it is merely a less repugnant way of restating the "what-the-traffic-will-bear" doctrine. The history of the development of a system of rates has nothing to do with the fairness of such rates. Everyone who has given even a superficial study to the subject knows that there was nothing scientific whatever involved in the rates for electrical energy as first applied. To substantiate the position of the Rate Research Committee you give two citations, one from the report of the Massachusetts Gas and Electric Light Commissioners, and the other from the decision of the Railroad Commission of California. The citation from the Massachusetts Commission's Report does not seem to me to be a justification of the "what-the-traffic-will-bear" doctrine, for it is merely a statement of what has and is the practice. Most critics of the recommendation of Rate Research Committee are well aware of such practice, for that is precisely what they are criticizing. They question the fairness and justice of having the company which has a monopoly of the business *"dictate the price, controlled only by motives of business expendiency."*

Three viewpoints are involved in public-utility rate-making, legal, economic and moral. It may be perfectly legal for a public utility to fix the rate at what the market will bear and at the same time violate principles of justice and fairness. The citation from the Massachusetts Commission report is merely a legal and not a moral justification of the proposal of the Rate Research Committee. One is tempted to use the words of the California Railroad Commission and say: "The courts and commissions to the contrary notwithstanding" unfair practice can not be made fair by their edict.

The California Commission says: "When it becomes a question of performing the additional service, under the circumstances stated, the utility does not and should not look to the average expense of performing the unit of service, but look to the added cost and the added revenue alone, which added cost may be much less than the average cost per unit and which added revenue may be less than the average revenue that must be required per unit." If by average cost the Commission means the average cost before the additional service is performed, no objection can be made to the above statement. If, however, the statement means that the service company is to charge only the added cost, then such a decision leads to the most unfair and unjust discriminations. Your editorial says "the real purpose of the report of the Rate Research Committee was to propose a practical basis of rate-making, which would so reduce the fixed charges which existing customers must pay, that year by year reductions in all rates, and especially reductions in the rate to the very small users, would be possible." If the additional service is to pay only the added costs, how can the small user ever hope to get a reduction in rates? If the new business pays the additional costs and a fair profit, then, and then only, can the small user hope for relief; furthermore, if the small user pays what the market will bear, the company can take on additional business "below the actual cost of performing an average unit service." It is only fair that any additional service should pay its proper share of fixed charges as well as the additional costs incurred by such a business. This does not mean that the rates for the new business must be the same as those charged to other customers. Many factors will determine the exact rate, but it does mean that rates to be fair should be determined by cost of service and not value of service. If the previous customers of a utility are to receive no benefit by the increase in the company's business, it is immaterial to them whether or not the company gets the new business. *There is then no valid reason why a public utility should be a monopoly.* The value of the service to a customer is just as great when he patronizes a small concern as when he is served by one doing a large business, provided the service is adequate.

I am not quite so certain as the editor that Commissioner Erickson of the Wisconsin Railroad Commission, in his public papers, has justified the value-of-service theory. On page 226 of the August 1, 1914, issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN we find him quoted as saying: "Reasonable rates under normal conditions are made up of charges that are high enough to cover fair returns for the operating expenses including depreciation, and interest and profit on the fair value of the property and business involved." Then on page 285 of the August 8, 1914, issue we find him further quoted as follows: "One of the main functions of a utility commission is to investigate the situation and to determine what is the necessary cost of the factors of production to the utility and to the public, and to so distribute these costs through the rate schedules that each branch of the service and each customer are made to bear their just share of this cost. Higher rates than those for which all the factors of production, including capital and the enterpriser, can be had would seem to be unnecessary; lower rates than this means no service." There is not even a suggestion in these citations that the value of service should be the determining factor. I also find Mr. Erickson quoted on page 88 of the October, 1914, number of the *Engineering Magazine* by Mr. Ashley, who says: "Halford Erickson, of the Wisconsin Railroad Commission, has added the last chapter to this history of electric rates. 'The cost of service,' he says, 'becomes the basis for the rates which the public pays for the service.'" It would thus seem that there are others besides those who criticize the report of the Rate Research Committee who jump to conclusions.

There is one other item in your editorial to which I must take exception. You say that "the cost-of-service theory cannot be applied to the small user, but that the rate at which electricity must

be sold to this user is always lower than the cost of service would indicate." This fallacy that the business of the small customer is taken at a loss by the public utilities has been repeated *ad nauseam*. I know of one very prosperous company which in 1911 made a profit of 30 per cent on its short-hour, incandescent-lamp load, and only 0.2 per cent on its long-hour, large-customer, power load. The precise profit that the company made on its smallest user I do not know, and doubt very much whether the company or any one else can determine this exactly. That the group of small customers has yielded a handsome profit is shown by the 20-per-cent dividends that the company is declaring. The rates of this company have been determined by the cost-of-service theory, and not by what-the-market-will-bear doctrine. Since the date given above the rates to the small user have been twice reduced without proportional reduction to the large customers. The facts are that in many instances it is the small user that makes low rates possible to large customers whose rates are determined by what-the market-will-bear theory.

The objection to using such a theory for rate-making is that it leads to rank discrimination and injustice. Perhaps the most unequal treatment results from the equal treatment of unequals.

C. M. JANSKY.

Madison, Wis., January 2, 1915.

Cheaper Wiring.

To the Editor:

I note that at a meeting of the varied interests of the electrical industry which was held in New York City at the Biltmore Hotel on December 22, there seems to have been aroused a strong protest to the introduction of a new method of wiring small buildings in locations where it is impossible to introduce the electric service with the present methods, due to the expense. This method has been in use for some years in Europe with much success. Why the electrical contractor or the manufacturer objects to this increase of business which it certainly means to all concerned, I am at a loss to understand. As an electrical contractor and a member of this Committee on Wiring of Existing Buildings, the subject was given considerable study and thought for almost two years. The objectionable features if there were any were eliminated, that is, all American fittings were to be used and not the foreign fittings.

The question of a fire hazard was carefully investigated by the committee, and it was found that in the European countries they have five per cent of the fires we have in this country.

The committee also considered the limitations of this new method of wiring which was only to be used in small installations of one circuit, and had to be run on the surface, same as we at present run wooden and metal molding. The new method would make a much neater job. Of course, it could not be used for concealed work or to be put in a fireproof building, or in a fine apartment house or residence, any more than molding, cleat or knob work is used today in such places.

It is not expected that this new method of wiring will diminish the amount of wiring done by present methods, but instead will be a big stimulus to those methods as well as to the industry as a whole. It is expected that the new method will open up to wiring contractors as well as to central stations a big field that is not now served on account of the expense of present methods.

Why the contractor should object to this additional business I am interested to know. We might just as well object to the use of the Ford car, for those that could not use a Packard car; the objection seems to me to be about as reasonable.

GEORGE WEIDERMAN,
George Weiderman Electric Company, Inc.
Brooklyn, N. Y., December 31, 1914.

Cheaper Electric Wiring.

To the Editor:

In looking over your issue of December 26 I note the editorial on "Cheaper Electric Wiring and the Manufacturers of Standard Wiring Devices."

The writer has been connected with the wiring business almost from its beginning and has always been an advocate of a radical change in our system of wiring cheaper buildings, and has always advocated using the ground for one side of the line; that is, if an ordinary wire is used, use one side extra heavy insulation and the other simply a bare wire soldered to the gas pipe, if any, otherwise carried back and soldered to the water pipes.

The concentric system of wiring is nothing more nor less than the above system with a little more expensive wire or system of conductors. This could be adopted without any change whatever in our present wiring devices. There is one other form of wiring that we have never seen advocated or developed that we believe would materially reduce the cost of wiring cheap frame buildings. This would be a wire with a standard code insulation of rubber and braid with a flexible conduit woven directly on the wire. This would give the same insulation that we now have when the wire is pulled into the flexible conduit, but of smaller diameter and even under our present rules would admit of fishing in walls and ceilings without the use of porcelain supporters or tubing. This would particularly facilitate the installation of switches and outlets where it is difficult to take up floor or get into the wall. This also would admit of using the present devices without any change whatever.

It has sometime seemed that the wiring rules and devices have been especially built to increase the sales of material rather than to increase the sale of current. A reduction in the cost of wiring would no more reduce the sale of material than did the introduction of the tungsten lamps reduce the income of the electric lighting companies. While it might decrease the sale of certain items, it would so increase the sale of other items made by the same people that they would be as much benefited by it as would the lighting companies.

I am writing this article simply to help interest central-station men, as well as the manufacturers, in doing everything possible to increase the number of lighting customers.

JOHN A. CAVANAUGH,
Superintendent Light and Power, Benton Harbor-St. Joe Railway and Light Company.
Benton Harbor, Mich., December 29, 1914.

Electric Company Not Liable for Death of Employee.

A decision by the Public Utilities Commission of Maine in the case of Norman Flye, an employee of the Androscoggin Electric Company of Lewiston, who was killed December 1 at a substation of the Portland & Lewiston Interurban Railroad, acquits the company of any blame in the matter, and finds that the machinery was suitably insulated. The deceased had evidently climbed upon an iron rod which surrounded a high-tension oil switch, one end of the rod being attached to the concrete base on which the switch stood. Apparently the operator had been in the act of cleaning the connection of one unit of the switch and had come in contact with charged apparatus carrying 33,000 volts. The danger of touching the connection must have been apparent, says the Commission, and the casualty was entirely accidental.

Ohio Meter Conference.

The Meter Committee of the Ohio Electric Light Association will hold a conference at Zanesville, O., on January 22, beginning at 1:00 p. m. at the Chamber of Commerce, Peoples Bank Building.

Papers will be presented by J. L. Wright, of Toledo, on "Diplomacy of Metermen Dealing With the Public," and by Wilford Judy, of Newark, on "Some Common Mistakes in Meter Connections."

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 18.

The dimensions of the magnetic circuit of the 100-kilowatt, 230-volt four-pole dynamo shown in Fig. 19 are as follows: Mean lengths of sections of magnetic circuit—each field yoke (*BCD*), 29 inches; each field core and pole shoe, (*AB* or *DE*), 8 inches; each armature path (*FG*), 16 inches; each air-gap (*EF* or *GA*), 0.25 inch. Mean cross-sectional areas (perpendicular to magnetic flux)—field yoke, 0.5 square foot; field core, 1.1 square feet; air-gap, 1.3 square feet; armature (each magnetic path), 0.35 square foot. The field yoke, field core and pole shoes are made of cast steel and the armature is made of annealed sheet-steel punchings. The magnetization curves for these materials are given in Fig. 20. (*a*) Assuming that the air-gap flux equals 85 per cent of the field-core flux, find the number of ampere-turns per pole required to produce a flux density of 60,000 lines per square inch in the air-gap. (*b*) Assuming that the machine is to be operated as a shunt generator with a shunt-field loss of two per cent of the output, that 25 per cent of the shunt-field drop is to be in the shunt-field rheostat and that the mean length of a shunt-field turn is 5 feet, find the proper size of shunt-field wire which will satisfy the conditions of question *a*.

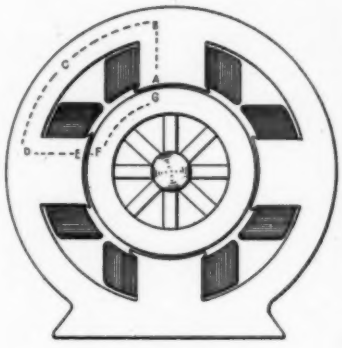


Fig. 19.

ALTERNATING CURRENTS.

Problem 68.

A three-phase, 60-cycle alternating-current generator is rated to deliver 5,000 kilovolt-amperes at 6,600 volts. The armature windings are connected in star and the field structure has 30 poles. The average resistance of the armature winding measured between any two terminals by direct current is 0.084 ohm at 25 degrees centigrade. The ratio of effective resistance to the measured resistance at this temperature is 1.55. The open-circuit and short-circuit characteristics and the saturation curve for zero power-factor are given by the following test data:

Abscissas	Ordinates		
Field Current	Open-Circuit Terminal Voltage	Short-Circuit Armature Current	Terminal Voltage, 438 Amperes at Zero Power-factor
64	3070	438	0
100	4800	680	1800
150	6500	1020	4200
200	7400	....	5700
255	7950	....	6600
275	8150	....	6900

(*a*) What is the rated speed? (*b*) What is the full-load armature current? (*c*) If this generator delivers 4,000 kilovolt-amperes at its rated voltage and 82 per cent power-factor, what is its kilowatt output and what is the armature current? (*d*) What is the resistance of the armature winding per phase at 25 degrees centigrade, and at 70 degrees centigrade?

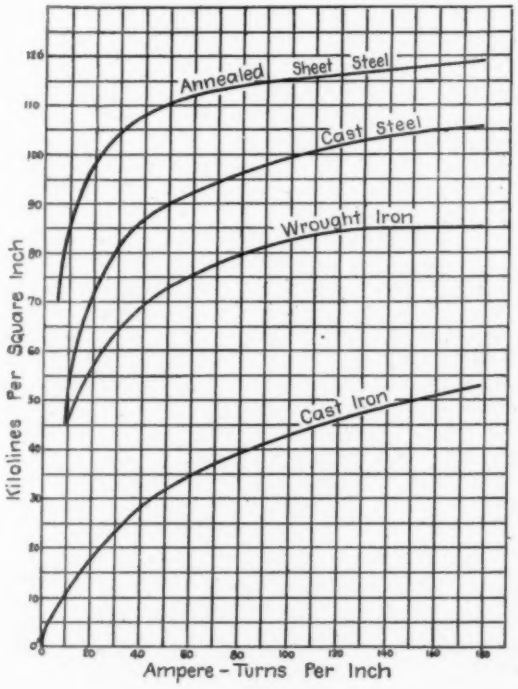


Fig. 20.

(*e*) What is the effective resistance of the armature winding per phase at 25 degrees centigrade, and at 70 degrees centigrade? (*f*) What is the synchronous reactance per phase, calculated by using (1) the short-circuit data and (2) the saturation curve for zero power-factor? (*g*) What is the reaction of the armature for a current of 456 amperes in terms of field current, calculated by using (1) the short-circuit data and (2) the saturation curve for zero power-factor?

SOLUTION OF PROBLEM 18.

Since the area of each air-gap is 1.3×144, or 187 square inches, and the flux density in the air gap is to be 60,000 lines per square inch, the total flux crossing each air-gap must be 187×60,000, 11,200,000 lines or 11,200 kilolines. Since this flux divides in the armature the flux in each armature path will be 11,200/2 or 5,600 kilolines. The flux in the field core will equal 11,200/0.85 or 13,200 kilolines and the flux in the yoke will equal one-half of this or 6,600 kilolines.

Dividing the flux in any section by the area gives the flux density as follows:
Field yoke, 6,600/0.5×144=91.7 kilolines per square inch.
Field core, 13,200/1.1×144=83.4 kilolines per square inch.
Air-gap, (stated) =60.0 kilolines per square inch.
Armature, 5,600/0.35×144=111.0 kilolines per square inch.

The magnetization curves shown in Fig. 20 are plotted from experimental data and give the number of ampere-turns required per inch to establish a given flux density in the various kinds of iron and steel used in the manufacture of dynamo-electric machinery. It should be noted that cast iron requires the most and annealed sheet steel the least number of ampere-turns per inch for a given flux density. The ampere-turns per inch (nI) required to establish a given flux density (B) in the air-gap is given by [31] $nI=0.313\ B$ ampere-turns per inch.

The ampere-turns required for any part of the magnetic circuit is found by multiplying the ampere-turns per inch corresponding to the flux density by the mean length of that part.

The ampere-turns required for each section is then obtained as follows:

Field yoke,	60×29	=1,740 ampere-turns
Field cores (two),	36×8×2=	576 ampere-turns
Armature,	57×16 =	912 ampere-turns
Air-gaps (two),	0.313×60,000×.25×2=	9,390 ampere-turns
Total		12,618 ampere-turns

This number of ampere-turns is required to maintain the required flux density throughout the path $A\ B\ C\ D\ E\ F\ G\ A$ and since such a circuit links two field spools the ampere-turns on each spool must equal (say) 12,600/2 or 6,300 ampere-turns.

Answer to Question a.

Since the function of each field spool is the same the number of ampere-turns per pole must be 6,300.

Answer to Question b.

From the conditions stated in the question the power loss in the shunt field winding must be 0.02×100,000 or 2,000 watts, and the shunt field current must be 2,000/230 or 8.7 amperes. The total number of ampere-turns to be provided equals 6,300×4 or 25,200 ampere-turns, and since the field spools are connected in series and must not take more than 8.7 amperes there must be 25,200/8.7 or 2,900 turns wound on the field. The mean length per turn being five feet, the total length of the field winding is 5×2,900 or 14,500 feet.

Twenty-five per cent of the total drop being in the shunt-field rheostat the drop in the field winding will be 0.75×230 or 172 volts. The resistance of the winding must then be 172/8.7 or 19.8 ohms. The total length being 14,500 feet the resistance per 1,000 feet must be 19.8/14.5 or 1.37 ohms. The nearest commercial size of copper wire possessing the proper resistance and carrying capacity is a No. 10.

The above result should be checked to see if there is sufficient space for winding 725 turns of No. 10 wire upon each field core. Square wire or strip copper is sometimes used for field conductors for heavier currents such as exist in the series windings of large machines as such wires require less space than round wires.

The multipolar dynamo possesses the following advantages over the bipolar dynamo: (1) A shorter magnetic circuit which effects a saving in both iron and copper; (2) easier placement of form-wound coils on armature owing to their shorter span; (3) lower armature resistance and brush current for lap windings, and (4) a better appearance, a point often emphasized by salesmen. The disadvantages are (1) greater magnetic leakage, and (2) a general complexity in connections, brush-gear, etc.

SOLUTION OF PROBLEM 68.

Answer to Question a.

While the armature conductors move from one north pole to the next north pole, or, in revolving-field alternators, while the field poles move the distance between adjacent like poles, the current and voltage both go through their complete cycle of values. If the alternator has P poles there will be one-half as many, or $P/2$, cycles for each revolution. If there are N revolutions per minute there will be $(N/60)\ (P/2)$ cycles per second. The frequency, f, in cycles per second is therefore

[41a] $f=NP/120$

In this case the number of revolutions per minute, N, is

$$N=120\times 60/30$$
$$=240.$$

Answer to Question b.

The output of an alternator is limited by the armature current it will safely carry. If the current is too great the heat developed in the armature winding will be sufficient to injure the insulation. The rated capacity of three-phase alternator in kilovolt-amperes is equal to three times the product of the terminal voltage per phase in kilovolts and the full-load armature current. Since the armature windings of this generator are connected in star, the armature current is the same as the line current, and the rated terminal voltage is the $\sqrt{3}$ times the voltage per phase.

By [31a] $V_p=6,600/\sqrt{3}$
$=3,810$ volts.

By the principle just stated the full-load armature current is

$$I=5,000/(3\times 3.81)$$
$$=438 \text{ amperes.}$$

Answer to Question c.

The power output of any generator in kilowatts is the product of the kilovolt-amperes delivered and the power-factor. The kilowatt output is therefore

$4,000\times 0.82=3,280$ kilowatts.

The armature current is

$$I=4,000/(3\times 3.81)$$
$$=350 \text{ amperes.}$$

Answer to Question d.

The operation of an alternator for a given condition of load is determined by its so-called constants. These are commonly taken as the effective resistance and the synchronous reactance. As a matter of fact neither of these is exactly constant. The effective resistance varies with the temperature, the armature current and the power-factor. The variation due to temperature is easily taken into account, but the effects produced by variations in the armature current and the power-factor are so small and so difficult to correct for that they are generally ignored.

Taken all in all it is probably best to calculate *balanced* polyphase circuits per phase. In a three-phase circuit the phase current is the same as the line current for star connection, but is equal to the line current divided by $\sqrt{3}$ for the delta connection. See [29a]. The phase voltage is the same as the line voltage for the delta connection, but is equal to the line voltage divided by the $\sqrt{3}$ for the star connection. See [30a]. The phase resistance is one-half of the resistance measured between terminals for star connections, but is three-halves of the resistance between terminals for the delta connection.

The resistance of copper increases about 0.4 per cent per degree centigrade. The more exact method of calculating the effect of temperature is by using the formula recommended by the American Institute of Electrical Engineers

$$R_2=R_1[1+(t_2-t_1)/(234.5+t_1)]$$

R_2 is the resistance at the higher temperature, t_2; R_1 is the resistance at the lower temperature, t_1. The resistance per phase at 25 degrees centigrade is

$$R_{25}=0.84/2$$
$$=0.42 \text{ ohm.}$$

The resistance per phase at 70 degrees centigrade is

$$R_{70}=0.42[1+(70-25)/(234.5+25)]$$
$$=0.493 \text{ ohm.}$$

Answer to Question e.

The resistance of a circuit is equal to the power dissipated due to the current in it divided by the square of the current [See 4a]. When a circuit carries

an alternating current this quantity is greater than if the circuit carries a steady or direct current. With direct current it is called the true resistance and with alternating current it is called the effective resistance of the circuit. The effective resistance is equal to the true resistance plus a quantity which varies with the frequency and in some cases with the value of the current. The temperature may also affect it but in an alternator this factor is of so small account that it will be neglected.

The effective resistance of the armature per phase at 25 degrees centigrade is

$$R_e = 1.55 \times 0.42$$
$$= 0.651 \text{ ohm.}$$

The effective resistance thus exceeds the direct-current resistance by

$$0.651 - 0.42$$
$$= 0.231 \text{ ohm.}$$

At 70 degrees centigrade it will be the same amount greater. The effective resistance per phase at 70 degrees is

$$R_e = 0.493 + 0.231$$
$$= 0.724 \text{ ohm.}$$

Answer to Question f.

The other so-called constant is the synchronous reactance. This varies with the degree of saturation of the magnetic circuit and with the power-factor. The effect of the saturation of the magnetic circuit is easily corrected for, but the effect of the power-factor is difficult to take into account and is usually neglected. It is well to remember that the synchronous reactance may be influenced by the power-factor as conditions are sometimes observed that cannot be explained on the assumption that the power-factor has no effect.

There are two methods of calculating the synchronous reactance. The older one is to use the open-circuit and the short-circuit characteristics. The method at present recommended by the American Institute of Electrical Engineers corrects for the effect of saturation and to do this uses the open-circuit and the zero-power-factor characteristic. The open-circuit characteristic is plotted with field current as abscissas and with open-circuit *terminal* voltage as ordinates. The short-circuit characteristic is plotted with field current as abscissas and with the short-circuit *armature* current as ordinates. The zero-power-factor characteristic is plotted with field current as abscissas and with the *terminal* voltage as ordinates. When the data for this curve are being taken the conditions are adjusted so that the armature current is constant and the power-factor is as near zero as possible. By the first method the synchronous reactance is taken as the ratio of the open-circuit phase voltage to the short-circuit armature current for the same field current. When the field current is 64 amperes the open-circuit phase voltage is $3{,}070 \div \sqrt{3}$ and the short-circuit armature current is 438 amperes.

$$X_s = 3{,}070/\sqrt{3} \times 438$$
$$= 4.05 \text{ ohms.}$$

When the field current is 100 amperes the synchronous reactance would be

$$X_s = 4{,}800/\sqrt{3} \times 680$$
$$= 4.08 \text{ ohms}$$

When the field current is 150 amperes the synchronous reactance would be

$$X_s = 6{,}500/\sqrt{3} \times 1{,}020$$
$$= 3.68 \text{ ohms.}$$

Thus we see that for higher points on the saturation curve the synchronous reactance is less than it is at lower points. With the greatest allowable value of short-circuit current the saturation is far below its normal value and the synchronous reactance is always too small calculated from these data. If this method of calculation is to be used always find the reactance for the largest given value of the short-circuit armature current. In this case use 3.68 ohms.

The method recommended by the American Institute of Electrical Engineers for finding the synchronous reactance is to take the difference between the rated terminal voltage on the zero-power-factor curve and the open-circuit terminal voltage for the same field current and divide this by the armature current for which the zero-power-factor curve is given and again by $\sqrt{3}$ if the generator is connected in star. That is, in this case the synchronous reactance per phase is

$$X_s = (7{,}950 - 6{,}600)/438\sqrt{3}$$
$$= 1.78 \text{ ohms.}$$

This value is less than one-half of that found by the first method. It is, however, a very correct value and should be used whenever it is possible to obtain it.

Answer to Question g.

Instead of using the synchronous reactance we sometimes substitute for it the total reaction of the armature expressed in terms of field current. This is the field current which will produce the required current in the armature on short-circuit. Since the short-circuit characteristic is a straight line the reaction in this case is

$$A = 64 \times 456/438$$
$$= 66.6 \text{ amperes in the field.}$$

The method of calculating this reaction from the zero-power-factor curve is as follows. From the field current neces-

DIRECT CURRENTS.

Problem 10.

A solid cast-steel ring, 10 inches in mean diameter and 4 square inches in cross-sectional area, is wound uniformly with 1,000 turns of No. 18 insulated copper wire, the total length of the wire being 650 feet. The magnetization curve for the cast steel is shown in Fig. 20 (see Problem 18). Assuming the temperature of the winding to be 50 degrees centigrade, find the inductance of the winding when (*a*) an emf. of two volts and (*b*) an emf. of 10 volts is impressed upon the winding. With a wooden ring substituted for the cast-steel ring find the inductance of the winding when (*c*) an emf. of two volts and (*d*) an emf. of 10 volts is impressed upon the winding.

This problem illustrates the meaning of inductance.

ALTERNATING CURRENTS.

Problem 69.

The three-phase generator described in Problem 68 is delivering its rated current to an inductive load at the rated terminal voltage and a power-factor of 0.84. The temperature of the armature winding may be taken as 85 degrees centigrade. In the calculations use the synchronous reactance found from the zero-power-factor curve, as this gives the best results. (*a*) What is the necessary field current? (*b*) With this field current what will be the terminal voltage if the alternator delivers its rated current at unit power-factor? (*c*) If this alternator delivers a condensive load of 4,000 kilowatts at the rated terminal voltage and a power-factor of 0.90, what is the necessary field current? (*d*) What would be the open-circuit terminal voltage if this latter load were removed?

This problem illustrates the synchronous-reactance method of calculating the field current of an alternating-current generator.

Solutions of the above problems and two new problems will be printed in the next issue.

sary to produce the rated terminal voltage on the zero-power-factor curve subtract the field current necessary to produce the same voltage on open circuit. Divide this difference by the current for which the zero-power-factor curve is taken and multiply by the required armature current. That is, in this case, the reaction in field amperes is

$$A=(255-155.6)\,456/438$$
$$=103.5 \text{ amperes.}$$

The field current necessary to produce 6,600 volts on open circuit is

$$I_f=150+50(6{,}600-6{,}500)/(7{,}400-6{,}500)$$
$$=155.6 \text{ amperes.}$$

Civil Service Examination for Electrical Draftsman.

On February 3 and 4 an examination will be held at the usual places by the United States Civil Service Commission to fill the position of electrical draftsman in the United States Navy Yards and in the Navy Department offices at Washington, D. C. At entrance this position commands a salary of $3.52 to $5.52 per day. The duties of this position require the origination and supervisory preparation of electrical installation plans aboard ship for power, lighting, interior communication, radiotelegraphy, switchboards, including specifications, estimates, etc.

The examinations will cover mathematics, electrical machinery and materials, drawing and designing; 60 per cent of the final marking will depend on the foregoing, 40 per cent will be determined by the education, training and experience of the applicants. These must be 22 years or over in age. Further details regarding the examination and copies of application form 1312 relating to this examination can be obtained from the United States Civil Service Commission, Washington, D. C.

Kansas City Electric Club Elects Officers.

Members of the Kansas City Electric Club and of the Jovian Order got together on the evening of December 29, at the annual banquet of the Electric Club.

The chief interest attached to the election of officers for 1915 by the Electric Club. This resulted as follows:

E. E. Stigall, Kansas City Electric Light Company, president; J. D. Todd, Western Electric Company, first vice-president; E. F. Hardy, second vice-president; A. P. Denton, Denton Engineering Company, third vice-president; J. E. Launder, Independent Electric Machinery Company, fourth vice-president; F. H. Penberthy, General Electric Company, secretary and treasurer; H. W. Rittenhof, W. Morgan Hand, F. M. Bernardin and W. J. Squire, executive committeemen.

A "Made In The U. S. A." Industrial Exposition.

A "Made In The U. S. A. Industrial Exposition," to be held at the Grand Central Palace, New York, March 6 to 13, is the latest development in the nation-wide movement to popularize and permanently establish the "Made In The U. S. A." slogan or national trade-mark and increase American industry and trade.

This exposition is designed to show "American Made" and "American Grown" products in practically all branches of business and it is held at a time of the year when New York is the Mecca of mercantile buyers from every section of the United States and this army of merchants is to be supplemented this year by a large number of South American and other foreign buyers who have heretofore gone to Europe at this same season.

The exposition committee includes in its membership William H. Matthia, president, American Hardware Manufacturers' Association, and president, National Enameling and Stamping Company; G. W. Forney, Jr., president, National Cloak, Suit, Skirt and Dress Manufacturers' Association; H. T. Dewey, president, American Wine Growers' Association; Col. George Pope, president, National Association of Manufacturers; F. W. Teeple, president, American Piano Manufacturers' Association; Charles B. Warren, president, Board of Commerce, Detroit, Mich.; William Woodhead, president, Associated Advertising Clubs of the World; Harry Tipper, president, Advertising Men's League of New York City, executive committee member, "Made In The U. S. A." Products Association; Lee Anderson, president, "Made In The U. S. A." Committee, Board of Commerce, Detroit, president, Adcraft Club, Detroit, and president, Advertising Affiliation of Rochester, Buffalo, Cleveland and Detroit; Edwin C. Johnson, publisher, *American Exporter;* Robert W. Nelson, president, American Type Founders' Company; Joseph French Johnson, president, Alexander Hamilton Institute; Walter C. Cole, secretary, "Made In U. S." Committee, Board of Commerce, Detroit; J. Clyde Oswald, editor, *American Printer,* and president, Federation of Trade Press Associations; Ralph M. Bates, editor, *Housefurnishing Review;* Joseph O'Gorman, editor, *Pottery, Glass and Brass Salesman;* Evan Johnson, editor, *Office Appliances;* Henry G. Lord, *Textile World Record;* M. C. Robbins, vice-president, David Williams Company; J. Newton Nind, president and editor, *Furniture Manufacturer and Artisan;* James S. McHugh, Joseph P. McHugh and Son; Charles A. Stone, president, Chamber of Commerce, Troy, N. Y.; F. D. Mitchell, secretary-treasurer, American Hardware Manufacturers' Association; William M. Pratt, president, Goodell-Pratt Company; George W. Williams, president, J. B. Williams Company; A. L. Riker, vice-president, The Locomobile Company of America; Augustus T. Seymour, president, Chamber of Commerce, Columbus, Ohio; R. Z. Spaulding, president, Chamber of Commerce, Binghamton, N. Y.; R. B. Naylor, secretary, Board of Trade, Wheeling, W. Va.; George R. Wallace, Fitchburg Paper Company; Mell R. Wilkinson, president, Chamber of Commerce, Atlanta, Ga., and Arthur Letts, president, National Retail Dry Goods Association.

The "Made In U. S. A. Industrial Exposition" has been placed under the management of the National Exposition Company, of which Harry A. Cochrane is president, with executive offices in the Fifth Avenue Building, New York. Mr. Cochrane is the originator, organizer and manager of the Annual Business Show and Efficiency Exposition, the Wearing Apparel, Fabric, Style and Fashion Show, held in Madison Square Garden in 1909; the National Household Show, the Brooklyn Automobile Show, the Gas Appliances Exposition and the National Printing, Lithographing, Publishing, Paper, Advertising, Business Efficiency and Allied Trades Exposition held in the Grand Central Palace, New York, last April and to be presented in Chicago next June at the time of the annual convention of the Associated Advertising Clubs of the World.

Central-Station Meeting Planned for Boston.

A "Question Box Convention" will be held under the auspices of the New England Section, N. E. L. A., on March 9 and 10, at the City Club, Boston, Mass. There will be sessions mornings and afternoons, and on the evening of March 9 a visit will be made to the Boston Auto Show, the second evening being given to a banquet and meeting of central-station men and automobile interests, both gas and electric, when matters of general traffic interest in Boston and other New England cities will be discussed.

The first day's sessions will be devoted to central-station problems, and the second day's to electric vehicles and their relation to the central station. No set papers will be prepared, but the whole convention will be a heart-to-heart conference on matters vital to the business represented. Committees on information, club relations, and on the question box, will be announced later, as will also the names of the manager of the convention and a manager for each day's sessions.

EXPORT TRADE AND HOW TO GET IT.—I.

By G. F. Bagge-Féron.

This is the first of a series of articles written by an electrical man and commercial traveler who has lived in a vast number of foreign countries and accumulated extended knowledge and intimate experience regarding international trade relations. They are intended particularly for the American manufacturer and business man desirous of establishing trade relations abroad, especially in Latin America.

During the past few years many important articles in regard to foreign trade expansion have appeared in the daily press and in various trade journals. But many of the real elements to be taken into account and which will interest every newcomer in the foreign field have not been explained. The first of these articles will deal with preliminary and general principles, particulary with regard to commerce with Central and South America. The same principles apply, however, more or less to nearly all other foreign trade, whether it be with Spain, Russia, Sweden, China, etc.

That it is possible for the American manufacturer to branch out and secure foreign connections directly and to compete successfully with the merchants of other exporting nations is too well known, but the difficulties in getting started in the right way are enormous and practically too much for the average busines man to understand easily. Still, with a little push and skill, it is as easy to branch out to another country as it is to another state inside the Union.

Knowledge of Foreign Languages.

The situation in the commercial field in general and in certain special respects has changed considerably in the United States during the last decade, but the export trade has shown rather slow increase. Probably the most important reason for this is that facilities for communicating with people of foreign tongues are rendered difficult because comparatively few technical men and clerks understand any foreign languages, especially Spanish or Portuguese, which languages are an absolute necessity in order to come into direct touch with the countries south of us. European countries, especially Germany, have had an advantage over others because every youth who has acquired knowledge in either commercial or technical lines does not consider himself fit for even an average position if he does not master at least the English language, and since about 1890 not only English but also Spanish.

Of course, the reason that the average American has no or very little knowledge of foreign languages is because of our isolated geographical situation; the distances and connections with foreign people are very much larger than is the case in the relatively small surface that Europe covers, with its exceptional number of distinct languages. In some countries where three or four languages are used daily, I have noticed that Englishmen particularly have much difficulty in picking up other tongues. Therefore, all other people desirous of getting in contact with English business houses have usually been compelled to correspond in English. A similar condition was noticeable in France, but in the last few decades a considerable number of young French people have been studying German besides English. For a Scandinavian commercial or technical man it is considered essential to know well both English and German, if not French as well.

In Italy and Spain the first supplementary language of interest is French, which is most cultivated; after that German.

There are many advantages in knowing some foreign languages. It is much easier to get a broader view in nearly everything, and in the commercial line it gives an exact understanding of the meaning of trade literature and price lists. Therefore, in efforts to extend trade relations with Latin American countries the first and cardinal requirement is to become familiar with the Spanish language and to some extent Portuguese.

The Brazilians, like other people, love their national language, and the foreigner who is equipped only with Spanish will meet failure from the start. Broken Portuguese, or French or even German will be better received than current Castilian; so Spanish should not be attempted in that territory.

Nearly all Spanish-speaking people find considerable difficulty in understanding English and, therefore, if any business man who wishes to capture the southern market does not become familiar with the language which his prospective customers use, he will certainly have a very hard time and proceed very slowly. It is absolutely essential that the office force handling the correspondence and clerical end of the business be thoroughly posted in the language used by the various foreign customers; at the very least they must be able to understand all essential points coming up in business documents and correspondence in general. It is needless to say that a Spanish letter received by an Argentine business house, for instance, will receive better attention because it can be handled by anyone in the office, than if it were an English letter that would have to be turned over to some one of the staff that understands English.

Trade Literature.

After a firm or certain members of a firm have become acquainted with Spanish, the first thing to do is to get up in that language some printed matter with all the illustrations and cuts possible, since pictures speak stronger than words and make a much greater impression on the mind of most people in the southern countries. If it is not possible to complete the catalog, folder or other pamphlet by including the exact price, it is advisable to leave the price out entirely, this to be given later when a direct trade connection is to be cultivated.

During the preparation of the printed matter, the office force should prepare addresses in accordance with the Trade Directory of South America. This trade directory was issued by the Bureau of Foreign and Domestic Commerce and can be obtained from the Superintendent of Documents, Washington, D. C., for $1.00 by money order or check payable to the Superintendent of Documents. This and a number of other important and very valuable government publications have been prepared with great care and at considerable expense by the Department of Commerce for the benefit of American manufacturers and exporters. These publications are not for indiscriminate distribution but are obtainable only by those for whom they were prepared. Among these publications and most essential from the start are the following, all of which are obtainable from the Superintendent of Documents for the prices mentioned:

"Promotion of Commerce," M. S. No. 6E, 1914, gratis.

Publication on "Latin America and West Indies," M. S. No. 17, 1914, gratis.

"Factors in Foreign Trade," M. S. No. 7, 1912, 5 cents.

"Packing for Export," M. S. No. 5, 1911, 15 cents.

"Foreign Credit," S. A. S. No. 62, 1913, 30 cents.

"Trade Directory of South America," M. S. No. 13, 1914, $1.00.

"Foreign Publications for Advertising American Goods," M. S. No. 10, 1913, 25 cents.

"Banking and Credit in Argentina, Brazil, Chile, Peru," S. A. S. No. 90, 1914, 10 cents.

"Transportation Rates to the West Coast of South America," S. A. S. No.72, 1913, 10 cents.

"South America as an Export Field," S. A. S. No. 81, 1914, 25 cents.

"Cuba as a Buyer and Seller," S. A. S. No. 61, 1912, 5 cents.

"Trade Development in Argentina,"

S. A. S. No. 43, 1911, 10 cents.

"Trade Development in Latin America," S. A. S. No. 45, 1911, 5 cents.

For any firm anxious of entering the South American trade especially, and also for other countries, the first of the publications mentioned above is especially valuable. It contains a full list of special publications covering practically every corner of the globe and from this a selection of such publications can be made for each individual territory in which the firm expects to become interested.

Proper Packing.

One of the most important matters in regard to shipments is that of proper packing. In the above list the publication entitled "Packing for Export" gives very much valuable information about how to pack different classes of goods. In European practice it has been customary to use several well established methods of packing and a few of these may be mentioned here.

For merchandise which may be affected or spoiled by water, either rain, sea water of merely the dampness found in tropical regions, zinc-lined cases are always used. These cases are made of strong wood three-quarter inch thick for the small boxes and one inch for the larger ones. They are lined with sheet zinc, which is carefully soldered at every joint to make the box hermetically sealed or air-tight. Other sheet metals are not suitable on account of possible rusting. Nailing or securing the lining to the wood would permit water to enter. This may occur readily since it is often the custom to leave boxes uncovered on docks or in the lighters, where they may be exposed to heavy tropical rains. After the zinc-lined box has been carefully packed, the top sheet of zinc is soldered on and then the box cover finally nailed down very carefully so that no nail pierces the zinc lining.

Boxes with oiled paper or other special waterproof paper are generally used for such merchandise as is not so delicate and subject to deterioration from moisture. This protection is usually sufficient for the bulkier electrical material. This packing is much cheaper than the zinc-lined box and at least prevents the goods from being soaked with water. Sometimes the oiled paper is laid in double layers and in such a way that it overlaps sheet by sheet. Very large articles, such as bulky machinery, automobiles, etc., are usually crated. Machinery should be very carefully greased with protective paste at least on all parts where the metal has been machined. Usually such surfaces are painted with a thin coating of protecting paste which can later be easily removed with kerosene or other oil.

It may be of interest to call attention to the proper marking or labeling of cases, bales, etc. The shorter this labeling is the clearer and better, since any superfluous wording is of no value whatever, as the persons handling the goods in transit seldom understand the language used on elaborate labels. A very plain marking, as for example "A. B. C. & Co., No. 3658, Callao, Peru," is all that is needed. This makes it much easier for everybody concerned in the transaction, for instance in writing out bills of lading or manifests, and in sorting up the goods on the dock or in the custom house, etc. Besides this main marking, the box should have some plain indication of its weight in kilograms "brutto" or gross (that is merchandise and box) and "netto." It is also necessary to give the content in cubic feet or cubic meters. Certain classes of goods are not charged for by weight in transit, but are charged for by the space occupied. Very often kegs, drums, barrels, bales, etc., are charged both in regard to weight and cubical contents, this being occasionally determined by the judgment of the officials of the transportation company.

Foreign Currency, Weights and Measures.

Another subject that needs careful study is that of the currency systems and the weights and measures used in the foreign countries with whom business relations are to be established. One of the publications mentioned above, "Factors in Foreign Trade," gives complete data concerning the language, currency, weights, measures, postal rates, parcel-post facilities, etc., of the different foreign countries. The majority of the leading countries have fortunately adopted the metric system, which is quite easy to learn. Where this almost universal system is used, weights and measures must be given in it and not in our pounds, feet, quarts, etc., because foreigners find it too troublesome to figure in the English system.

This is also true of monetary values. Prices must be given so they are readily understood in the currency of respective countries. This gives little trouble to the American exporter, as far as South America is concerned at least, because the southern merchants are accustomed to buying and paying for their goods in terms of the "Dollar Oro," which means our equivalent *gold dollar* value. This is in contrast to the dollars used in their internal commerce. For instance, in Argentina the ordinary currency is paper money, "Peso papel," or "Moneda Nacional," always indicated by $.... *M/N*. For internal currency "Pesos oro" are also used. Practically every transaction with foreign concerns is handled in gold values, or $....*Oro*. In Cuba, United States coins are in common use and the Havana street-car system, for instance, collects fares in our nickels and charges considerably more if copper coins are offered.

Prices.

Nearly all Latin American places of any importance, and shipping ports particularly, are in such settled condition as regards shipping to them that it is not very difficult to obtain actual freight rates to those ports. It is, therefore, easy for the exporter to be able to give prices in his catalogs based on goods delivered "Franco Port of Destination" or c. i. f. (cost, insurance, freight).

The old custom of giving the prices f. o. b. factory or some American port no longer holds in foreign commerce, in the first place because the importer has too much difficulty in finding out exactly how much the goods will cost him before they arrive; in the second place because the exporters of other nations have established the custom of giving prices c. i. f. The only thing which it is safe and right to do as regards selling price is to give this either c. i. f. point of destination, or at least f. o. b. at the nearest American port. One of the above mentioned publications, "Transportation Rates to the Western Coast of South America" enables one to figure out with much accuracy the shipping costs for any article and to any place. It is quite possible even to determine the shipping costs to many interior cities, which include the custom charges paid on entry to the country. In starting the foreign trade, however, this is perhaps not necessary because the importer can take care of the customs charge and the freight from the port of entry to his local town.

After having prepared the catalog and the price lists in, say, the Spanish language, and also with code words, if suitable, there are three ways as regards method of working up trade: (1) by mail, (2) agency, (3) salesman. These three ways we shall discuss more carefully later on. A certain point of prime importance, however, is the condition on which one intends to sell his goods.

Terms and Credit.

To get the client to accept the goods c. o. d. against the bill of lading is now a very rare instance, as the territory has been so well canvassed by other exporters who have established liberal credit terms of payment. Consequently, any American exporter must be able to grant similar conditions of payment to prospective clients in order to compete with these other exporters. The buyers are used to it and moreover circumstances in general force them to require a longer term for payment. For instance, in ordinary business transacted by mail it takes generally six months from the time the written order is sent until the buyer receives the goods ordered; this is generally the case when these goods come from a European manufacturer, and in some cases the purchaser has to wait even

longer. On account of this long period before actual delivery of the goods, and on account of the relatively high cost of shipping a small lot, the placing of orders of substantial size is the natural consequence. Now since the buyer must dispose of a large stock order, he needs more time and on account of his limited capital must usually secure the longest term of settlement possible. Therefore, it has become the custom, in the Latin countries at least, to pay for the goods three or six months after they have been received. In the case of machinery and in certain lines of trade, or where the sum is a very large one, it is quite frequent that payment is extended over 9, 12 or even 18 months, this being under special contracts under which the goods remain the property of the seller until the final payment is made.

European firms could certainly not afford to grant such terms of settlement without getting equivalent value; therefore, they add a certain percentage to the price, partly so as to cover interest on the money tied up, and partly also for the long risk involved. Every buyer knows this is the case and is prepared to pay the price under such, to an American, unusual conditions.

That everybody likes to turn over his capital as quickly as possible is very natural, but in dealing with the people in the southern countries at least an important factor must be taken to account. There everything is slow and everybody is slow; they take their time and do all things leisurely; the word "Manana" is familiar to many people. There is no use quarreling with this habit of the people, it is not only their privilege to do as they please, but it must be borne in mind that these national habits are very old and well established; moreover, the tropical climate has something to do with it and another factor is that they have many holidays and half-holidays which reduce the number of actual working or business days. The strenuous business life that we are used to one does not find in Latin America. There can be related innumerable cases of business transactions in those countries which we could not dream of.

One thing is to be kept in mind by every business man attempting export business and that is to furnish the goods absolutely to conform to the statements made in the catalog as to quality, and also to safeguard fully the time of specified delivery. With respect to packing instructions, the utmost care must be taken to carry them out, as the buyer has very good reasons for his specifications. Sometimes a different method of packing results in a higher tariff classification. At other times the buyer wishes to reship in parts to interior points without repacking, and such points may be accessible only by mule.

Failures of this nature have caused many exporters very heavy losses. In some cases the goods shipped did not correspond at all to samples which the buyer had actually seen. The southern people know that they have the conditions in their control and they will not be slow to take advantage of the situation under any pretext and refuse goods that are not as specified. It is not to be wondered at, because what could the local merchants do with goods which they could dispose of only at a greatly reduced or ruinous price compared to the cost to the merchant himself? Failure to attend to this matter immediately ruins the business reputation of an exporting house.

Therefore, in accepting any export order great prudence is required in all details of the transaction; the price must be taken into account. European houses have made it a practice to do their business through either established agencies or local branch houses; their agents are in constant touch with the purchaser, and when long credit has been accorded they know from day to day the doings and business conditions of the merchant. As a rule the native people are conservative and upright in their dealings. The native himself is a good man to deal with when you can reach him directly without the intervention of many middlemen or commission agents. Through direct dealing one can obtain a far better price for the goods than through a number of middlemen, and sometimes the selling price is really stupendous in comparison to the quotations one is used to make in domestic trade.

The present quiet period is the very best logical time for the preparation of printed matter and for investigating all angles of the foreign trade prospects so as to have everything ready when conditions will become more settled after the violent international upheaval caused by the European war.

Agents and Traveling Salesmen.

Regarding the different ways of proceeding to capture the foreign market, the simplest way, of course, would be to do this through the mail only, beginning a correspondence with the particular parties one would desire to enter into business relations with. This has its serious drawbacks on account of the social characteristics of the people and their desire to, if possible, see samples of the goods or have them explained in detail.

Therefore, a much better way is to send a salesman or two to visit the principal cities. As it is necessary to establish good personal relations with the prospective clients, it is advisable to stay some time in each city and not to attempt to make a rush trip such as we are accustomed to in this country. The clients as a rule cannot be convinced by the first interview. One has to let them study the matter in their own way and see them again and again. Finally when one has attained much closer acquaintance with the party the placing of the order is readily accomplished. During these preliminary visits the salesman finds out many things in regard to the actual business condition of the prospective purchaser and his standing in the community, which are of great value to the exporting house and furnish it with correct knowledge regarding the credit that it is safe to offer to the purchaser under the circumstances prevailing.

The initial cost of such a first trip can be reduced very materially if the salesman is able to master the language of the country visited and is acquainted with the conditions sufficiently so as to take part in the home life; that is, so that it is not necessary for him to stay in an expensive hotel but rather in some quiet private house. To travel at low expense is naturally a matter acquired by experience only. For example, the writer has covered extensive territory in many different countries and become so familiar with the land and the people that it was possible to get along with $3 per day, exclusive of railroad and steamship transportation. In some cases where a much more rapid trip is necessary the expense may go up as high as $15 to $20 per day. However, it should be possible for the average salesman to get along in South America with an average of $4 to $5 per day, or even less, without any great hardship. It must be borne in mind, however, that the first visit must not be looked upon as a lucrative or profitable trip. It lays the foundation for later and more substantial results which frequently bring ten-fold the business of the first trip.

Another way would be to establish a branch office and set aside an amount to be used in conquering the new field. Such a branch office can hardly reach a paying basis before at least a year has elapsed. After that, however, it will prove to be a fine investment if it is handled correctly.

(To be continued.)

[The following instalments will deal especially with technical data pertaining to different localities with the object of enabling the American manufacturer of electric appliances and specialties to modify his output so as to make it fit local conditions of electrical supply by either central stations or isolated plants.]

What Is Electricity?

At the meeting of the Pittsburgh Section, American Institute of Electrical Engineers, on Tuesday evening, January 12, Saul Dushman, of the General Electric Company, will lecture on "Recent Views on Matter and Energy." The meeting will be held at 2511 Oliver Building, Pittsburgh, Pa., at 8:15 p. m.

EFFECTS OF FREQUENCY UPON TRANSFORMERS.

By Gordon Fox.

Occasionally it happens that transformers designed for a given frequency are available where service of a different frequency is to be handled. It is therefore of interest to consider the relations existing between the frequency of the circuit and the behavior of the transformers.

The frequencies most commonly met are 25 cycles, 60 cycles and 133 cycles. We will consider the use of a 60-cycle transformer upon 25 cycles. The principles can thus be most clearly illustrated and can then be applied in a similar manner to other cases. Let us first put down a formula showing the relations between the different factors and then consider how each is related to the others. This formula follows:

$$V = 4.44\ A B N f / 10^8$$

V = applied voltage.
A = magnetic cross-section in square inches.
B = induction in lines per square inch.
N = number of turns in winding.
f = circuit frequency.

It will here be seen that the magnetic density is directly proportional to the voltage applied and inversely proportional to the frequency of the system, other things being equal.

Now let us return to our 60-cycle transformer which is to be operated upon 25 cycles. The frequency has here been cut to slightly less than half its intended value. Since the induction is inversely proportional to the frequency, the magnetic density becomes greatly increased. A heavy magnetizing current flows which tends to heat up the magnetizing winding. The increase in magnetic density greatly increases the iron losses. Therefore the transformer iron becomes markedly overheated and the winding is likely to burn out if kept in service for any length of time.

If the 60-cycle transformer is to be operated upon a 25-cycle circuit it is therefore necessary that the induction be reduced in some manner. Since the formula shows that the induction varies directly with the voltage, it is possible to reduce the magnetic density by reducing the impressed voltage. If the voltage at 25 cycles be one-half that for which the transformer is rated at 60 cycles, then the decrease in voltage will just about compensate for the decrease in frequency and the induction at 25 cycles, half voltage, will be only slightly higher than the induction at 60 cycles, full voltage. For a given connection the ratio of transformation remains the same at any frequency, the voltages always being approximately proportional to the number of turns. Let us say that our 60-cycle transformer is of the standard 2,200-1,100 to 220-110-volt rating. By connecting the primaries as for 2,200 volts and using them on a 1,100-volt, 25-cycle circuit we will obtain a fairly good operating condition. The secondary voltages will then be 110 or 55 volts, according to the manner in which the secondary leads are connected.

The rating of a transformer is the product of volts and amperes. The windings will have the same current capacity at 25 cycles as they had at 60 cycles, but the voltages have been reduced one half. The product is therefore correspondingly reduced and it

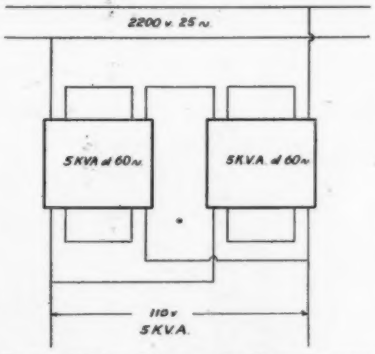


Fig. 1.—Wiring Diagram for Transformers.

will be seen that the 60-cycle transformer can only deliver about half its rated capacity upon a 25-cycle circuit connected in the above manner. This same line of reasoning shows why it is that 25-cycle transformers are larger and heavier for the same rating than are those designed for 60 cycles.

In this particular case we have conveniently assumed an available 1,100-volt, 25-cycle circuit and a 2,200-volt, 60-cycle transformer. If the 25-cycle circuit were also of 2,200 volts pressure, it would then become necessary to connect two 60-cycle transformers in series, the primaries of each being connected as for a 2,200-volt, 60-cycle circuit. This arrangement is shown in Fig. 1. The secondaries may then be connected for 55 or 110 or 220 volts as desired. The figure shows the connection for 110-volt secondaries.

In an opposite manner 25-cycle transformers may be successfully utilized upon 60-cycle circuits. It is here possible to simply transfer the transformer from the 25-cycle to the 60-cycle circuit. It will then operate at a low induction and deliver an amount of 60-cycle power corresponding to the 25-cycle rating. If it is desired to utilize the full capacity of the transformer it may be operated upon a 60-cycle voltage double that of its rated 25-cycle voltage providing, of course, that the insulation will stand such procedure. Since most transformers are tested out under double voltage without oil at the factories, they are usually well enough insulated to make this arrangement allowable. A point which enters here, however, is that of eddy currents within the conductors themselves. At 60 cycles these are likely to be higher than at 25 cycles so that the regulation may be poorer and the copper losses greater at the higher frequency and the allowable rating may be thereby somewhat reduced.

It is not infrequent that small 133-cycle plants are changed over to more modern 60-cycle service. In such cases it is possible to utilize some of the 133-cycle transformers at 60 cycles in the same manner that the 60-cycle transformers previously discussed were operated upon a 25-cycle circuit. By impressing half voltage upon the primaries at about half the rated frequency occurring they will deliver about half their rated output without undue heating. On a basis of 24-hour losses and efficiency this procedure may not pay. To determine the feasibility of the plan it is well to measure the losses by the standard transformer testing methods and compare with the accomplishments of standard 60-cycle transformers.

Meeting of Illinois Contractors.

The Electrical Contractors' Association of the State of Illinois will hold the winter meeting at the Morrison Hotel, Chicago, on January 15 and 16. There will be open sessions on Friday afternoon and Saturday morning. On Friday there will be a general discussion, and on Saturday an address by G. B. Muldaur, of the Society for Electrical Development, and talks by the jobbers.

Closed sessions will be held on Friday morning, when H. N. Tolles will make the opening address, and on Saturday afternoon, when there will be a talk on "Consistent Contracting."

On Friday evening there will be an entertainment and on Saturday evening a banquet.

Standardization of Controller Requirements.

The Association of Iron and Steel Electrical Engineers will hold its regular monthly meeting this Saturday evening, January 9, at the Seventh Avenue Hotel, Pittsburgh, Pa. C. T. Henderson will address the meeting on "A Plea for Standardization of Magnetic-Switch-Type Controller Requirements."

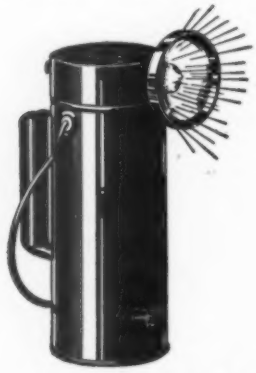
The meeting will be preceded by a dinner at 6:30 p. m. at $1.25 per plate.

New Electrical and Mechanical Appliances

Powerful Reflector for Delta Electric Hand Lamp.

The Delta Electric Company, Marion, Ind., manufacturer of electrical specialties, is now supplying a powerful new reflector on the Delta electric hand lamp. When the model department of the company undertook designing a regular silver parabolic reflector for its lamp, a peculiar and unusually effective combination existing between the curve of the reflector and certain construction details in the lamp was discovered. By working the two together, the Delta designers succeeded in creating a radically intensified power of projecting light.

In making subsequent tests, engineers of the company performed unusual feats with the reflector-lamp combination, since adopted for all Delta electric hand lamps. With the lamp stationed 200 feet away, a newspaper was found easily readable. At a distance of 400 feet, the bright glare from the light appeared almost as intense as from a powerful automobile headlight. An amusing incident occurred which, while discomfiting to the sales manager of the Delta Electric Company, afforded considerable mirth to the technical experts. It also served to illustrate the remarkable strength of the light thrown by the lamp.



Delta Hand Lamp with New Reflector.

One evening the officials of the Delta Electric Company gathered along a railroad line near the factory, while an engineer walked down the track to measure the distance for a test. Not paying attention to this individual, the sales manager was startled, on looking up to see what he believed instantly to be a locomotive with a big, powerful headlight coming down the track. He made a sudden leap for safety, and his companion scrambled after him. Closer observation developed that the approaching glare was cast by a Delta electric hand lamp equipped with the new reflector.

This highly effective reflector, together with its efficient tungsten lamp, makes the Delta electric hand lamp an exceptionally powerful and economical light source, considering that it is operated by a single dry cell.

Simplex Electric Protective-Stopper-Spinning Machine.

The demand for bottles of the non-refillable type has led to the development of the machine illustrated herewith, which is used for spinning Simplex protective stoppers into the neck of bottles. These stoppers consist of a copper cage which is heavily silver-plated and which carries a plated ball about three-eighths inch in diameter.

Stopper-Spinner.

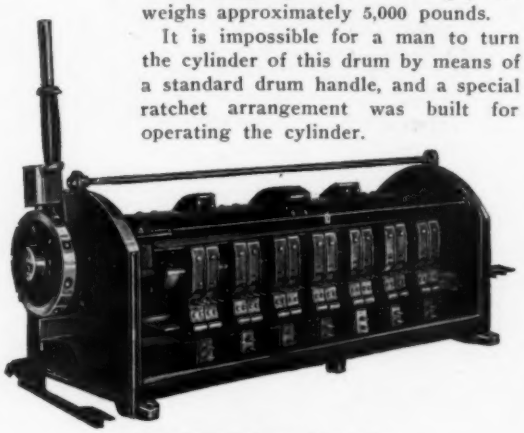
The bottle is placed on the stand, which is raised to meet the spindle that spins the stopper into the grooves in the neck of the bottle. When spun in place it is impossible to remove this stopper without destroying the bottle and the bottle becomes practically non-refillable. Experiments under the most favorable conditions in a laboratory demonstrated that over one-half hour was required to fill one of these protected bottles by the vacuum process.

The machines are driven by one-quarter and one-sixth-horsepower direct-current and alternating-current motors manufactured by the Robbins & Myers Company, Springfield, O., and the spinning machine and stoppers are manufactured by the Somplex Protective Stopper Company, Baltimore, Md.

Large Drum Controller.

The controller illustrated herewith is probably the largest drum controller that has ever been built and was furnished by the Industrial Controller Company, formerly the Independent Electric Manufacturing Company, of Milwaukee, Wis., for use in connection with an electric steel-melting plant. This drum controller is eight feet six inches long by three feet high, and weighs approximately 5,000 pounds.

It is impossible for a man to turn the cylinder of this drum by means of a standard drum handle, and a special ratchet arrangement was built for operating the cylinder.



Large Drum-Type Controller.

The fingers of this drum are of cast copper with removable tips and each of the 28 fingers weighs 16 pounds.

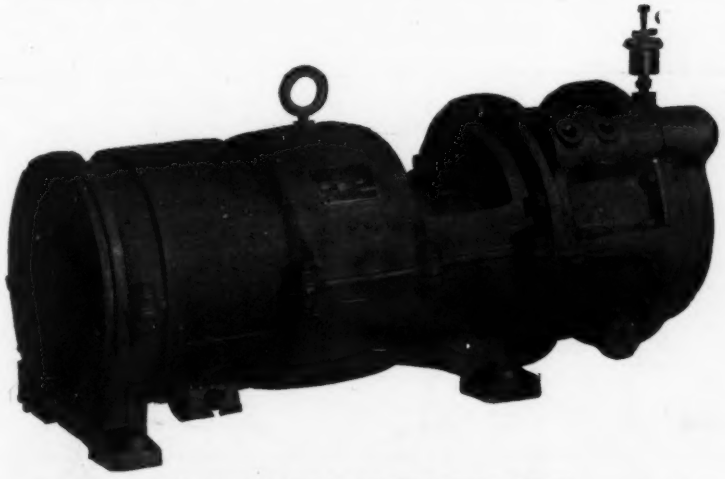
Individual Electric Lighting Plants for Steam Shovels.

One of the problems which the Utah Copper Company encountered in operating its steam shovels at night was to provide satisfactory illumination for them. A considerable number of these shovels must work on the night shift so as to maintain the large tonnage output required by the company's mills at Magna and Arthur, Utah.

The shovels work on terraces that

have been cut in the side of the mountain and dig from a bank of hard porphyry. The bank in front of the shovel must be continuously loosened by heavy blasts, and these blasts scatter considerable rock in the vicinity of the shovels. Also rock from the upper terraces is often loosened and rolls down onto the lower terraces. For night work adequate illumination is imperative, not only for the bank from which the shovel digs but also around the shovels themselves to permit the necessary inspections and adjustments and to afford safety for the workmen.

Acetylene had been tried for this work, but proved troublesome, costly and somewhat dangerous, so illumination by means of electricity was adopted. The general illumination of the bank is furnished by a battery of powerful projector searchlights located on the opposite side of the canyon from which the shovels dig.



Turbogenerator Set for Lighting Steam Shovels.

To supply local illumination, about twenty incandescent lamps were placed on each shovel, but to get current to them proved quite a problem. One of the difficulties was the fact that the shovels are in motion. A method was devised of mounting a reel on each shovel, which reel carried a semi-flexible cable that was unwound onto the ground as the shovel proceeded. One end of this cable was tapped onto a power circuit carried by poles. This arrangement gave considerable trouble during the several years it was in operation. Rocks rolling from one terrace to another would carry away wires or poles and blasts would frequently throw rock that would damage the semi-flexible cables along the ground. Not only were such accidents costly on account of the replacements required, but individual shovels were frequently put out of commission due to all lights going out when some rock disturbed by another shovel on a higher level crashed down through its feeder line.

The whole problem was one of considerable annoyance to the mine management until in December, 1913, the Westinghouse Electric & Manufacturing Company furnished the Utah Copper Company for trial one of its one-kilowatt general-utility turbogenerator outfits. This set was mounted directly on the shovel, being fastened to the underside of the main shovel frame, and was supplied with steam from the boiler furnishing steam to the shovel.

Upon the installation of this set no attempt was made to supply the shovel with any electric power other than that produced by the turbogenerator, and this shovel with its little self-contained power plant was immediately freed from all interruptions caused by accidents to its supply of illumination. The shovel made such a good record for itself that the Utah Copper Company purchased the turbogenerator outfit furnished on trial and about four months later ordered, for its other shovels that do most of the night work, six more outfits which are now being installed.

The turbogenerator outfits on these seven shovels save the Utah Copper Company about 50,000 feet of the No. 8 wire per year, which, however is insignificant compared with the benefits derived due to the freedom of the shovels from delays in operation formerly caused by failure of the lighting system.

One of these sets will operate on arc lamp and a few incandescents at the same time or about 40 25-watt incandescents alone. Practically no attention is required for the set because it is designed to operate for long periods without care. There are no delicate adjustments to make and every part is accessible for inspection.

Full rating is developed on steam pressure between 90 and 250 pounds. A governor controls the speed and keeps it uniform. A fixed resistance furnishes voltage regulation and a rheostat is provided to adjust the voltage when the number of lamps in use is varied. Hence, in spite of the abrupt changes in steam pressure and load that characterize shovel service, steady light is obtained.

Meadows Manufacturing Company's Get-Together Meeting.

On New Year's Day the Meadows Manufacturing Company's executives, entire sales force and all male office employees gathered at the office and factory at Pontiac, Ill., for the purpose of getting a line on the 1915 work and gathering ideas from each other. During the morning and afternoon interesting and instructive talks on the various lines of goods manufactured were made by John Rocke, William J. Read, Thomas Roche and E. J. LaDue.

At 7:30 p. m. the men all met at the Imperial Hotel, where they were banqueted by the company. After all had feasted there was a general discussion of business matters and up-to-date ways of getting business, in which all took part, John Rocke, president and manager, acting as toastmaster.

Those present at the banquet were: John Rocke, William Rocke, William J. Read, Thomas Roche, Frank W. Schuster, E. J. LaDue, Edwin Rocke, A. B. Pixley, Ed. Engel, John Engel, Ira A. Irwin, Carl Irwin, J. W. Dykman, James Patterson, Y. W. Pruyn, Charles H. Ganson and George Engel.

On January 2 they all met again at the office and factory, where further discussions and talks were made to the great benefit of all present. A large amount of enthusiasm and optimism was shown at this meeting, which, together with many other favorable conditions, points to an exceptionally big year for the Meadows company.

Every one at the meeting was pleased to learn that, although an adverse year for many manufacturers, the Meadows Manufacturing Company's business in the past year has increased over the previous year. When others were laying off their salesmen and cutting down their advertising, the Meadows Manufacturing Company increased its sales force and enlarged its advertising appropriation. This progressiveness on its part, together with the line of Meadows customer satisfiers, is to a large extent responsible for the increased business.

The City Hospital on Blackwell's Island, New York City, has been equipped with electric lights. Electric elevators will soon be in operation also. Heretofore oil lamps were used.

Semi-Outdoor Portable Substation for Berkshire Street Railway.

The Berkshire Street Railway Company, Pittsfield, Mass., placed in service last summer a new semi-outdoor type of portable substation for the purpose of supplementing the power supply on certain heavily loaded sections of the road during the increased summer excursion traffic. The substation was built by the General Electric Company and has a continuous capacity of 300 kilowatts at 600 volts, transforming from a 33,000-volt, 25-cycle, three-phase supply.

By providing additional energy at any point where traffic may be temporarily abnormal, a portable substation of this type assures a continuity of power supply at a lower cost than would be incurred by the installation of spare units in many of the substations of an electric railway system, resulting in a considerable reduction in investment for equipment that under normal conditions might lie idle for long periods. Moreover, the portable substation can be transported quickly to a disabled section, where it will only be necessary to make connections to the high-tension lines and direct-current trolley or feeders for a temporary power supply. It is also very useful for furnishing power to extensions while under construction.

The portable substation for this railway represents one of the most modern designs. It consists of an inclosed operating compartment containing the synchronous converter, the three-panel switchboard and the three-unit electric heaters; an inclosed central room for the multigap lightning-arrester equipment; and an open section for the main transformer, the current transformer, automatic oil switch, choke coils, disconnecting knife switches, etc. Owing to the low clearances of the various bridges on the lines, the car has been kept within the comparatively low height of 11 feet, 6 inches above the rails, including the running board.

The car is an all-steel structure of very substantial construction. In the open end of the car, four vertical channels with the four upper channels forming the cross-framing constitute the support for the disconnecting switches and choke coils. A snow shield formed of sheet steel and framed with angles extends from the center on top of the support over to a wooden-block base on the transformer top. This protects the high-tension bushings to the transformer, which are brought out in a horizontal position because of lack of overhead clearance on the road, and also those to the oil-switch units and the current transformer. A short cover likewise extends over the incoming line leads and those to the lightning-arrester compartments at the other end of the supporting frame. The incoming insulators on each side of the choke coils are suspended from cross steel angles tied into the framing. The current transformer and the oil-switch units are fastened down with the usual wooden cleats and angle lugs riveted to the floor plates. In the lightning-arrester compartment, a steel angle is placed longitudinally near the top of the compartment and riveted to the partitions to anchor and support the arrester units.

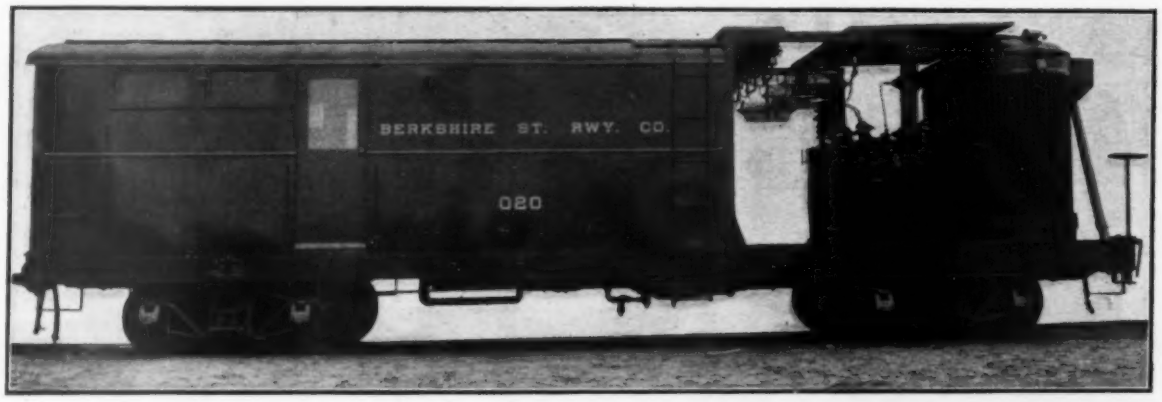
The side and roof framing of the closed sections and partitions of the car consists of steel channels and angles properly braced and riveted together. The operating compartment end of the car is bolted to the sides and roof so that it may be entirely removed for the installation or removal of the apparatus. The section of the roof over the converter is also bolted down so that it may be readily removed for installing or dismantling the apparatus when a crane is available. A galvanized sheet-metal ceiling is built on the interior so as to form air pockets between it and the roof sheathing to prevent any direct radiation of heat when the car is standing in the sun and also to drain any condensation or possible leakage to one side of the car away from the apparatus.

The car is provided with four doors, one on each side entering into the operating or synchronous-converter compartment, one in the side of the partition connecting the operating and lightning-arrester compartments, and one entering the latter compartment at the other end from the outdoor portion of the substation. The doors are built with metal-protected wood frames and have top panels of wire glass. In addition to locks, they are provided with a chain with hook and eye to prevent ingress when the door is left partially open. Grab rails and steps are furnished at the side doors, as well as steps and grab rails at each end of the car, ladders at the sides leading to the roof and a wooden running roof board in accordance with safety appliance standards. Four top wire-glass windows are located two on each side in the operating compartment. They are pivoted at the center and are provided with catches to hold them in open or closed positions.

The car is supplied with standard brake riggings and shoes acting on all wheels of both trucks and operated from automatic air-brake equipment with hose connections, as the car must conform to MCB standards throughout to be shipped over steam railroad lines to its destination. A handwheel and brake shaft is also provided at the outdoor end for operating the brakes on one truck only.

The electrical equipment includes a three-phase, 25-cycle, 600-volt, commutating-pole, synchronous converter operating at 750 revolutions per minute. The transformer connections are arranged for alternating-current starting from 50-percent secondary taps with series resistance to cut down the initial rush of current. The machine has a normal rating of 300 kilowatts continuously, 450 kilowatts for two hours and a momentary overload capacity of 900 kilowatts. This high overload capacity is considered a very important feature for interurban-railway substations.

The temperature guarantees and in-



Portable Substation for Converting 33,000-Volt, Three-Phase, Alternating Current to 600-Volt Direct Current.

sulation tests follow the recommendations of the American Institute of Electrical Engineers. The series field is designed to give practically flat compounding at all loads without shunt-field adjustment. The machine is equipped with speed-limiting device, mechanical end-play device, field-breakup switch, equalizer switch, 1,000-ampere negative line switch, field rheostat, back-of-board type starting resistance, and leveling device. The usual brush-raising device is also supplied for use in connection with alternating-current starting. The equalizer and negative line switches are mounted on the outer pillow block. An opening is provided in the floor for connecting the equalizer to a stationary substation, if parallel operation is desired.

The transformer is a three-phase, oil-insulated, self-cooled, outdoor type, rated 330 kilovolt-amperes. Voltage taps are arranged on the high-tension side for unusual flexibility, operating at either 33,000, 13,000 or 11,000 volts star by using either series or multiple connections of the primary coils. The low-tension winding is designed for 385 volts and is provided with the starting taps previously mentioned. Series resistance is also used in starting. In order to make the secondary leads weatherproof at the point of entrance, they are inclosed in a small sheet-iron box, from which the connections are carried to the switch panels through conduit. The transformer is designed with high inherent reactance to give practically flat compounding on the direct-current side of the converter. The transformer is rated in accordance with A. I. E. E. recommendations. Three times normal load on the converter, or 900 kilowatts can be carried momentarily. The high-potential insulation was tested to 66,000 volts on high-tension windings, and 2,000 volts on low-tension winding.

The current transformer for the automatic tripping device is a 15-30 ampere special outdoor type. It is installed in the outdoor section directly back of one of the oil-switch units and connected to the high-tension circuit. The automatic oil switch is a 300-ampere, 45,000-volt, triple-pole, single-throw, outdoor oil switch. The series transformer and tripping device are self-contained. The operating mechanism is entirely inclosed and the units are fitted with outdoor bushings, thus being adequately protected from exposure to the weather. The switch is provided with bell alarm to notify the attendant when it opens. This oil-switch trip is instantaneous in action so as to afford complete protection to the machines and feeders under short-circuit conditions.

The alternating-current lightning arrester is of the standard multigap type, consisting of a series of spark gaps shunted by graded resistances, but without series resistance. It may be connected for protection of either the 33,000-volt circuit or the 13,000 and 11,000-volt high-tension supply.

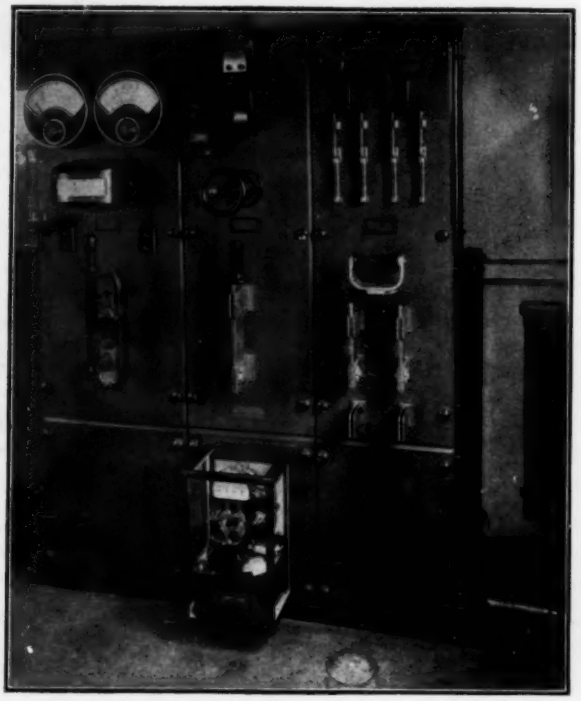
Three 33,000-volt, 300-ampere disconnecting switches are provided of the single-pole, single-throw, outdoor type. They are installed immediately under the high-tension entrance opening and are connected in the main line circuit so as to cut out all the apparatus in the station, including the lightning arrester. If it is necessary to make any adjustments on the lightning arrester, the line circuit will be opened and the lightning-arrester circuit disconnected by hand. An eight-foot switch hook is furnished for manual operation of the switches.

The three 200-ampere choke coils are of the cylindrical, outdoor, suspension type. They are supported in a horizontal position by the disconnecting switches at one end and by insulators at the other. The lightning arrester for the 600-volt direct-current feeder circuit is of the aluminum-cell type and is mounted inside the car back of the direct-current switchboard panel.

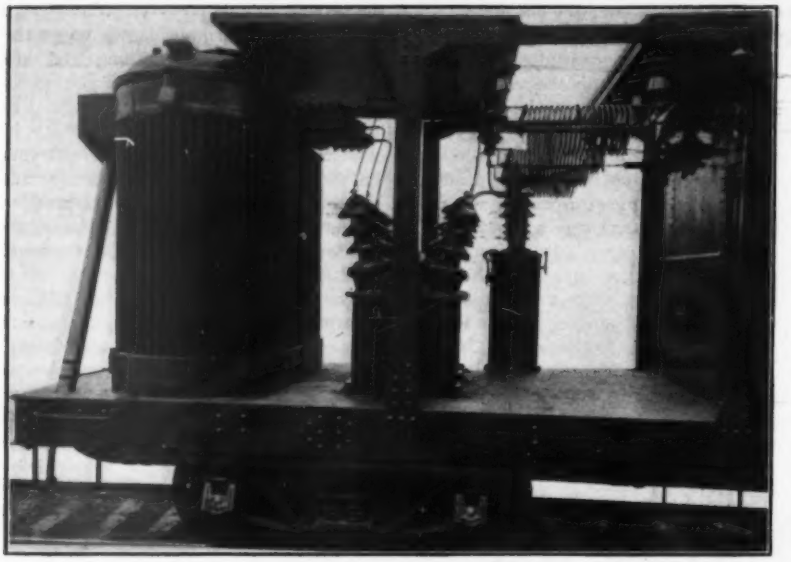
The switchboard has three panels, one for the main transformer, one for direct-current feeder, one for alternating-current starting. These panels are of natural black slate and are mounted on pipe framework. All three panels have 20-inch sub-bases. All instruments have a dull black finish to match the panels.

The equipment installed on the transformer panel consists of one 1,500-ampere ammeter with shunt; 750-volt voltmeter; 385-volt, 5-ampere wattless-component indicator with 300-0-300 kilowatt scale; operating lever for the automatic oil switch; two two-point potential receptacles; two-point plug and holder.

Commutating-Pole Synchronous Converter in Operating Compartment of Car.



Switchboard in Substation Car for Controlling Direct-Current Feeder, Transformer and Converter.



33,000-Volt Outdoor Equipment on Substation Car.

The direct-current feeder panel is equipped with one single-pole, 600-volt, 1,000-ampere, carbon-break, hand-operated circuit-breaker, with low-voltage release and bell alarm switch; handwheel with field rheostat; single-pole, single-throw, 600-volt, 1,000-ampere lever line switch; and a 600-volt, 1,500-ampere, two-wire recording watthour meter installed on the sub-base.

On the converter starting panel are installed a double-pole, double-throw, 800-ampere, synchronous-converter-starting switch and two double-pole, single-throw, 250-volt, 100-ampere lever switches with inclosed fuses on the front of the panel. These last mentioned switches furnish current to the lighting and heating circuits.

Current for lighting the two interior compartments and the outdoor section and for heating the operating compartment is taken from the partial-voltage taps on the transformer secondaries. The heaters are fastened to the partition and side of the car at one end of the switchboard. They consist of three units normally rated at 900 watts each. Each unit has two coils, making a total of six coils connected in parallel with separate switches on the heater to secure a gradation of heat.

An Electrical Tide Gauge.

As a result of an experience in tracing trouble to lamp service on a wharf property, F. R. Laws, of the Boston Edison Company, has suggested the use of a recording voltmeter as a tide gauge. By using a live ground connection immersed in the ocean and calibrating the voltmeter to read zero at low tide, marking the rise of the tide on the chart at foot intervals, one has both the record of the time and also a record of the waves. The current consumed at low tide would be nil, increasing at the same ratio as the rise of tide and the immersion of the ground pipe.

The unusual service trouble in Boston, which suggested this device, was the accidental grounding of live wires on an iron pipe running down a building into tide water. The pipe had been eaten away and the ground was thus effective only when the tide rose.

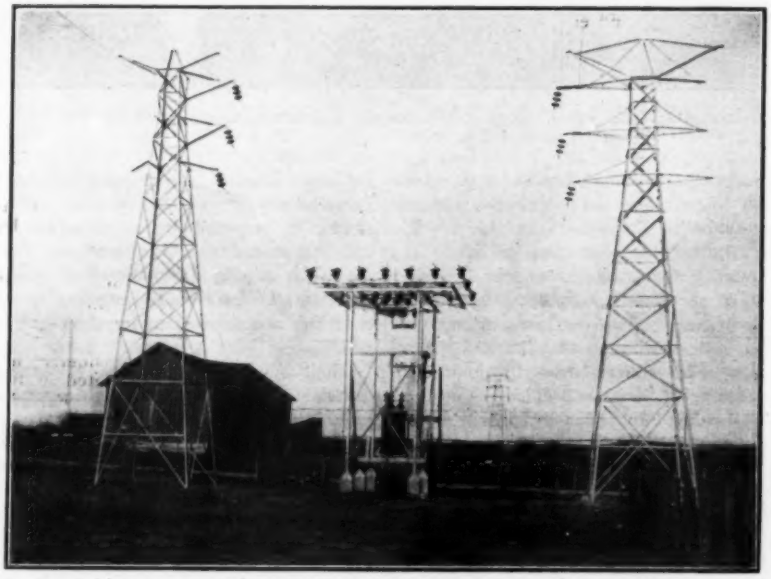
Selector-Type 66,000-Volt Outdoor Steel-Tower Substation.

The marked advance in the design and construction of high-tension outdoor steel-tower substations during the past year is well illustrated by the installation shown herewith. This station, having an initial capacity of 100 kilowatts and an ultimate capacity of 1,000 kilowatts, represents the latest development in low-cost equipment, and will be a strong factor in economically selling power.

In order that the three-phase transformer can be energized from either of two sources of power, a standard transmission tower was set off the right of way, and directly opposite a line tower, thus providing space for the double-throw switching substation. One set of three-phase line conductors was carried to the right-hand tower, thus "splitting" the system, and offering a ready means for carrying taps to the substation without crossing of the phase wires.

The three-phase switches are of the interlocked selector type, permitting power to be fed from either source without danger of throwing the switch systems together. Protection is secured by means of choke coils, horn gaps and carbon-tetrachloride fuses on the high-tension side, the low-tension side being controlled by an automatic 2,200-volt oil switch located in a small house at the base of the substation. This house also provides space for meters, spare parts, distribution switches, etc. The transformer rests on a transfer table, insuring ready means for handling units.

The 2,200-volt secondary leads are carried under the transformer platform into the cement house, and then pass through conduit to the overhead secondary, or town distribution. The three-phase transformer was manufactured by the Packard Electric Company, Warren, O., the entire substation with its equipment being of the standard type manufactured by the Delta-Star Electric Company, Chicago, Ill.



66,000-Volt Outdoor Steel-Tower Substation with Selector Switches.

Current Electrical News

ATLANTIC STATES.

CAMDEN, N. J.—In connection with the erection of an addition to its plant, the Victor Talking Machine Company is planning for the construction of a new power plant with a capacity of 2,000 horsepower. The plant is estimated to cost $150,000. Louis F. Geissler is general manager. A.

NEWARK, N. J.—The Maas & Waldstein Company will build a new power plant at its factory at Avenue R and the Passaic River. A.

POINT PLEASANT, N. J.—The Trenton, Lakewood & Seacoast Railway Company is planning for the erection of three electric power plants for operation of its new line, contract for which was recently awarded, from Trenton to Point Pleasant, via Lakewood. James H. Butcher is president.

TRENTON, N. J.—The Board of City Commissioners is planning for the installation of a new nitrogen-lamp street-lighting system in the business district. The Public Service Electric Company is negotiating with the city for the improvement. A.

WEEHAWKEN, N. J.—The Town Council of Union Hill has voted to replace the present arc-lamp street-lighting system with nitrogen lamps of improved type. The installation will comprise 43 1,000-candlepower lamps along Bergenline Avenue, and 214 600-candlepower lamps in other sections of the town. A.

CLARKSBURG, W. VA.—The Motor Ignition and Devices Company recently incorporated here with a capital stock of $400,000 by Ellis R. Diehm, W. L. Fleming and others, of Cleveland, O., will require considerable material and equipment in connection with its business of manufacturing ignition sets for gasoline engines.

WADLEY, GA.—The city has awarded a contract to the Singleton-Smith Company, Macon, Ga., to install an electric lighting plant with a storage battery system. The city has just voted $6,400 of bonds with which to install the plant and lighting system.

MILTON, FLA.—Water, Light & Sewerage Company is planning to purchase and install a 100-kilovolt-ampere, 60-cycle, 2,300-volt engine-driven generating unit. Also to purchase material for about one and one-half-mile transmission line. Address H. A. Mentz, manager.

NORTH CENTRAL STATES.

CINCINNATI, O.—A small electric light plant will be part of the equipment of a large motion-picture theater to be constructed in Price Hill, a Cincinnati suburb, by John W. Weinig and others, under plans by Zettel & Rapp. The building will cost about $35,000, and the wiring will include arrangements for four stores, as well as the theater. Bids will be asked shortly.

ELYRIA, O.—A municipal light plant may be established. Address city clerk.

WOODHULL, ILL.—The electric light system is to be extended into the Houghton Park addition. Address town clerk.

CEDAR LAKE, WIS.—The citizens of Turtle Lake are considering the matter of installing an electric light plant.

MADISON, WIS.—The Milwaukee Light, Heat and Traction Company has been granted a certificate of convenience and necessity to operate a second power transmission utility in the town of Delafield to furnish electric current for light, heat and power. The field is already occupied by E. Humphrey of the village of Delafield, but upon hearing it was determined that the Humphrey plant is not furnishing adequate service and the Milwaukee corporation has therefore been granted permission to operate there.

LAMBERTON, MINN.—The new electric light plant of this place has been purchased by Wherland Brothers of Redwood Falls, Minn. X.

MAPLETON, MINN.—Plans to construct within the next four months ten miles of transmission line are announced by C. E. Sellers, owner of the electric light plant of this city. In addition to the wire, insulators, meters and lightning arresters needed for the line, the extension is to open a field for a general supply of electrical appliances, such as cooking apparatus, vacuum cleaners and washing machines.

MINNEAPOLIS, MINN. — The Charles L. Pillsbury Company, consulting engineers, has just issued heating and electrical specifications for a new $200,000 biology building for the University of Minnesota. The contract for the electrical work is expected to amount to approximately $13,000. The building is constructed under the direction of the Minnesota State Board of Control. X.

MINNEAPOLIS, MINN.—The Minnesota State Board of Control has prepared for presentation to the legislature, which convenes this month, a detailed statement of the public work it recommends having done within the next two years. The specific electrical improvements recommended, aside from the electrical work involved in other buildings under consideration, is as follows: To be completed in 1915-1916—School for the blind, Redwing; rewiring main building, superintendent's residence, hospital and barn, $2,000. Power plant at the school for the feeble-minded, Faribault, $30,000; State public school, Owatonna, heating and power plant, $100,000; underground electric feeder system, $5,000. Home school for girls, Sauk Center, wiring hospital attic, $350. State Reformatory, St. Cloud, underground feeders and ground lighting system, $4,000. State sanitorium, Walker, Roentgen-ray installation, $5,000; ground lighting, telephone system and electric service extension, $6,500. Hospital for inebriates, Willmar, power plant improvements, $1,000. To be completed in 1916-1917—School for deaf, Faribault, rewiring laundry and hospital, $2,000. School for feebleminded, Faribault, ground lighting system, $2,000. State training school, Redwing, ground lighting system and underground feeders, $10,000. X.

RUSHMORE, MINN.—An electric system is being installed in this city by means of connection with Worthington, a town 10 miles distant. The 6,600-volt line is now being constructed. A 24-hour service will be maintained. The work of installing the system will be completed in the early spring. X.

DONNYBROOK, N. D.—Plans are being discussed for putting in an electric light plant here. Address town clerk.

GRANO, N. D.—The business men have decided to secure an electric light plant. It is proposed to have the new plant established within a few weeks. Address town clerk.

GREAT BEND, KANS.—Despite the fact that a recent plan was sidetracked, the merchants of Great Bend are agitating the movement for a white way.

MUSCOTAH, KANS.—An electric light system may be installed here soon. Address city clerk.

SALINA, KANS.—Beverly, a town of 300 inhabitants twenty-four miles from Salina, is installing an electric light plant which will be in operation shortly. This is one of the smallest towns in the state to have electric lights furnished by its own plant. M.

SOUTH CENTRAL STATES.

DANVILLE, KY. — Two "white ways" are in prospect for Danville, one on Lexington Avenue, to be lighted with electric cluster lights, and one on Maple Avenue, to be lighted with clusters of gas jets.

MASON, TENN.—Upon the completion of an independent telephone system and private water-works system, both giving entire satisfaction, the people of Mason are now turning their attention to the establishing of an electric light plant. A bond issue is proposed, and should the plan fall through the matter will be taken up by the citizens who backed the telephone and water-works systems.

DENTON, TEX.—The proposition of issuing $12,000 of bonds for extending the lighting and water system of the city will be voted on February 2.

GAINESVILLE, TEX.—A committee has been appointed to secure estimates for installing an electric light plant in connection with water system. Address mayor.

MISSION, TEX.—The city commission has under consideration the calling of an election of taxpayers to vote on the proposition of issuing bonds for the construction of an electric light and power plant. William Ferguson, mayor.

WESTERN STATES.

LUSK, WYO.—Bonds to the amount of $8,000 will be issued for the installation of a municipal electric lighting system. U.

LORDSBURG, N. M.—The Eighty-five Mining Company will install an electric hoist at its mine near here.

MOGOLLON, N. M.—It is announced that the Socorro Mining and Milling Company will expend about $90,000 in completing its electric power plant near here. It will supply power for the company's mines and for the operation of a number of other industrial plants of this section. D.

SODA SPRINGS, IDAHO.—The special election held here to vote on the issuance of $15,000 bonds for the installation of a municipal electric lighting system resulted in favor of the proposition. Paul Tipton is city clerk. U.

EVERETT, WASH.—The county commissioners have granted a franchise to the Jim Creek Water and Power Company for the installation of an electric distributing system along county roads to serve different points in the county.

FRESNO, CAL.—The city trustees have passed a resolution of intention for the construction of an ornamental lighting system on the principal streets of the city.

FRESNO, CAL.—The San Joaquin Light and Power Corporation has filed an application with the commission, requesting authority to purchase the Selma Waterworks, Madera Waterworks, Madera Light and Power Company, Lemoore Light and Power Company and Bakersfield Gas and Electric Light Company. These companies are subsidiaries of the San Joaquin corporation, and it is planned to consolidate them with the parent company.

KERMAN, CAL.—The Kerman Telephone Company is preparing to install a line into Barstow Colony, which will also give service to the town of Viola.

TULARE, CAL.—The city council has called for bids for an electrolier system, which will light 17 blocks in the business district of the city. There will be six lights to a block, three on each side of the street.

PROPOSALS.

LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until February 27, 1915, for lighting fixtures for the United States Post Office at Miles City, Mont. Drawings and specifications will be ready for delivery after January 15, and may be obtained from custodian at Miles City, or from the Supervising Architect, Washington, D. C.

INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until February 18, for interior lighting fixtures for the United States post office and courthouse at Lincoln, Neb. Drawings and specifications may be obtained from the custodian at Lincoln, or at the office of the Supervising Architect, Washington, D. C.

CONDUIT AND WIRING SYSTEM, AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., for a new conduit and wiring system, and interior lighting fixtures for the United States customhouse at St. Louis, Mo. Drawings and specifications may be obtained from the custodian of the building at St. Louis, or from the Supervising Architect, Washington, D. C.

ELECTRICAL EQUIPMENT, NAVY DEPARTMENT.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until January 19, for furnishing the following electrical equipment: Miscellaneous interior communication cable; 400,000 feet aerial silicon-bronze wire; miscellaneous double-conductor wire for portables; miscellaneous plain wire; miscellaneous magnet wire; 1,400 feet rattail wire, as per Schedule 7775; and 1,750 pounds copper trolley wire, as per Schedule 7772, all for delivery at Navy Yard, Brooklyn, N. Y.; 2,000 carbons for Adams-Bagnall lamps, as per Schedule 7772, for delivery at Navy Yard, Norfolk, Va.; one 100-horsepower induction motor, as per Schedule 7758, for delivery at Navy Yard, Washington, D. C.; 86 type CN telephones, as per Schedule 7762, for delivery at Navy Yard, Norfolk, Va.; two 120-kilowatt oil-cooled transformers, as per Schedule 7756, for delivery at Navy Yard, Washington, D. C.

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained by writing (mentioning file number) to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or to the nearest of its branches at Boston, New York, Atlanta, Chicago, New Orleans, Seattle and San Francisco.]

NO. 14,950. ELECTRICAL GOODS, DYNAMOS, ETC.—A business man in the East Indies informs an American consul that he wishes to receive catalogs and price lists from American exporters of electrical goods, dynamos, engines, labor-saving appliances, etc.

NO. 14,966. SEARCHLIGHTS.—A neutral government advises an American consular officer that it is in the market for six or eight searchlights for the army and navy; also portable searchlights, with gasoline engines, or with Edison accumulators. It is stated that the searchlights should be of 60 to 90 centimeters, and 100 to 150 centimeters in diameter; that they should be provided with the necessary electric power—14 horsepower for the smaller and 35 horsepower for the larger lights. Catalogs, or photographs, and price lists should be sent to the American consular officer.

NO. 14,968. ELECTRICAL SUPPLIES.—A firm in the West Indies informs an American consular officer that it desires to be placed in communication with American firms exporting electrical supplies of all kinds. Materials for wiring houses, etc., are desired in particular.

NO. 14,971. ELECTRIC HAND LAMPS.—An American commercial attache in a foreign capital advises that there is a market in that country for electric-light hand flashlamps for the use of pedestrians. The lamp should retail at about $1. The attache remarks that prompt action on the part of exporters of these articles should result in large sales.

NO. 14,975. ELECTRIC POCKET LAMPS AND DRY BATTERIES.—An import agent in northern Europe advises an American consular officer that he desires to hear from American exporters of electric pocket lamps and dry batteries.

NO. 14,977. ELECTRICAL SUPPLIES.—A merchant in a European capital has informed an American consular officer that he desires to act as agent in his country for an American manufacturer of electric supplies, such as accumulators, electrical appliances for automobiles, dynamos, transformers and wire installation. The merchant offers references as to his financial responsibility and is willing to give banker's security for such goods as he takes.

NO. 14,980. COPPER WIRE, DYNAMOS, MOTORS, ETC.—A commission merchant in Europe informs an American consular officer that he wishes to correspond with American manufacturers of bare copper wire (electrolytic and commercial), silicon-bronze wire, copper tubes and sheets, brass tubes and sheets, silver, platina, new silver, and lead wire, tin, zinc, and tinplate, dynamos, large and small electromotors, electric fans, stoves, kitchen utensils, material for electric-light installations, bells, telephones and apparatus, and all accessories for high and low-tension current lines. Correspondence may be in English.

NO. 14,981. CARBONS FOR ARC LAMPS.—An import agent in Europe informs an American consular officer that he wishes to hear from American exporters of carbons for arc lamps. It is stated that the agent has an extensive trade.

NO. 14,990. ELECTRICAL AND INDUSTRIAL MACHINERY.—An American consular officer in Europe reports that an American in that country wishes to establish a business for the representation of American goods. He wishes to represent American houses dealing in electrical, industrial, agricultural, and mining machinery. It is explained that the man has been employed in that country for the last ten years.

NO. 14,993. DRY CELLS.—An import agent in France has informed an American consul that he wishes to form connections with American manufacturers of dry cells for bells, for telegraphic and telephonic use, and for pocket lamps, and also of small electrical apparatus. He is desirous of obtaining terms to cover a stock of dry cells to be held at a distributive point.

NO. 15,001. INSULATORS.—A civil engineer, owner and manager of two stores in a European country, informs an American consular officer that he would like to hear from American manufacturers of insulators with a view of undertaking the exclusive sale of such goods in the country in which he is located.

NEW PUBLICATIONS.

ELECTRIC FURNACES.—The Bureau of Mines, Washington, D. C., has issued Bulletin 77, entitled "The Electric Furnace in Metallurgical

Work," by D. A. Lyon, R. M. Keeney and J. F. Cullen. This publication comprises 216 pages and is illustrated. Part I deals with design, construction and operation of furnaces; Part II with smelting of metals; Part III with the manufacture of ferro-alloys.

COAL IN CANADA.—The Canadian Department of Mines has issued bulletin No. 316 entitled "The Production of Coal and Coke in Canada during 1913," by John McLeish. This shows the output to be in excess of any previous year.

FINANCIAL NOTES.

Dividends.

	Term	Rate	Payable
Asso. Gas & El. pf.	Q	1. 5%	Jan. 15
Bell Tel. of Pa.	Q	1. 5%	Jan. 15
Cin., N. & C. Lt. & T.	Q	1. 5%	Jan. 15
Cin., N. & C. Lt. & T. pf.	Q	1.25%	Jan. 15
Citizens' Trac. pf.	S-A	3 %	Jan. 5
Commonwealth Ed.	Q	2 %	Feb. 1
Elec'l Util. Corp. pf.	Q	1.25%	Jan. 15
Elmira Water, Lt. & R. R. com.	—	2 %	Jan. 2
Elmira Water, Lt. & R. R. 1st pf.	Q	1.75%	Jan. 2
Elmira Water, Lt. & R. R. 2d pf.	Q	1.25%	Jan. 2
Houston Gas & El. pf.	Q	1.75%	Jan. 1
Ill. No. Util. pf.	Q	1. 5%	Feb. 1
No. States Pr. pf.	Q	1.75%	Jan. 15
Ottumwa Ry. & Lt. pf.	Q	1.75%	Jan. 15
P. S. Co. of No. Ill.	Q	1.25%	Feb. 1
P. S. Co. of No. Ill. pf.	Q	0. 5%	Feb. 1
So. New Eng. Tel.	Q	1.75%	Jan. 15
United Gas & El. pf.	S-A	2. 5%	Jan. 15
Westerly Lt. & Pr. pf.	Q	1.25%	Jan. 1
Westerly Lt. & Pr. com.	Q	$1	Feb. 15
West. Sts. Gas & El. pf.	Q	1.75%	Jan. 15

Reports of Earnings.

COMMONWEALTH POWER, RAILWAY & LIGHT.
(Including constituent companies.)

	1914	P. C. Inc.
November gross	$1,239,727	0.19
Net earnings	640,452	6.54
Surplus after charges	210,446	*5.39
Balance after preferred dividends	130,446	*8.42
Twelve months' gross	14,757,390	5.07
Net earnings	7,235,476	10.80
Surplus after charges	2,227,034	5.80
Balance after preferred dividends	1,267,034	10.67

*Decrease.

CONSUMERS POWER OF MICHIGAN.

	1914	1913
November gross	$303,692	$291,035
Net earnings	198,833	172,984
Surplus after charges	102,997	84,655
Balance after preferred dividends	69,497	57,155
Eleven months' gross	3,079,902	2,830,186
Net earnings	1,992,215	1,528,979
Surplus after charges	955,978	632,943
Balance after preferred dividends	632,478	341,943

PORTLAND RAILWAY, LIGHT & POWER.

	1914	1913
November gross	$ 494,626	$ 576,244
Net after taxes	236,987	303,994
Surplus after charges	53,921	127,569
Twelve months' gross	6,366,154	6,703,123
Net after taxes	3,081,882	3,402,001
Surplus after charges	916,695	1,417,481

SOUTHERN CALIFORNIA EDISON.

	1914	1913
November gross	$ 400,086	$ 391,822
Net earnings	216,717	182,520
Gross income	223,300	181,391
Surplus after charges	142,987	106,162
Balance after depreciation	72,987	41,162
Eleven months' gross	4,359,317	4,330,933
Net earnings	2,245,059	2,152,798
Gross income	2,303,300	2,161,646
Surplus after charges	1,455,931	1,381,847
Balance after depreciation	835,931	746,847

NORTHERN OHIO TRACTION & LIGHT.

	1914	1913
November gross	$ 286,732	$ 265,096
Net after taxes	100,723	81,095
Surplus after charges	50,463	31,722
Balance after preferred dividends	35,358	18,103
Eleven months' gross	3,319,704	2,989,155
Net after taxes	1,279,690	1,159,796
Surplus after charges	723,325	648,263
Balance after preferred dividends	557,683	510,689

PERSONAL MENTION.

MR. MONROE FRANKEL has been appointed assistant gas and electric inspector at Louisville, Ky., with supervision over the electrical work by City Inspector Parks.

MR. PETER J. BEISEL has been appointed city electrician of Allentown, Pa. He will have supervision over the fire and police call systems and all other electrical activities entered into by the city.

MR. GUY E. MITCHELL, of Westfield, Mass., has been appointed manager of the municipal lighting plant of that city. He succeeds Mr. Thomas T. Logie, who has brought the plant to a high state of efficiency.

MR. JAMES B. BROWN, vice-president of the Louisville (Ky.) Gas and Electric Company, has been elected president of the National Bank of Commerce, of Louisville. Previously he had been vice-president for a period of several years.

MR. CHARLES MITCHELL has been chosen as manager of the Corbin City (Ky.) Light and Water plants to succeed C. J. Mershon, resigned. Mr. Mitchell comes from Bardstown, Ky. The council also adopted a schedule of rates for the service.

MR. SAMUEL W. PENNYPACKER, ex-Governor of Pennsylvania, a member of the Public Service Commission of Pennsylvania, has been appointed chairman of that body to fill the uncompleted term of the late Nathaniel Ewing. By this action, the term of each of the commissioners is advanced one year.

MRS. ELIZABETH O. HILLER, one of the best known cooking experts in the United States, will demonstrate the merits of electric cooking at Sterling, Colo., for two weeks, beginning January 18. Mrs. Hiller will use Hughes electric ranges in her demonstration work. It is expected that she will have an audience of from two to four thousand per day.

MR. THEODORE N. VAIL, president of the American Telephone and Telegraph Company, has offered to present to the State of Vermont his large farm at Lyndonville, to be used as a school for girls, for special instruction and training in domestic economics and home making. Mr. Vail has already established an agricultural school for boys at Lyndon, Vt.

MR. CHARLES R. GOW, who was assistant engineer and superintendent of construction of the earlier Boston subway, has been appointed a member of the Boston Excise Board. Mr. Gow is 41 years of age. He graduated from Tufts College Engineering School in 1893. For 15 years he has engaged in engineering construction and is a lecturer at Massachusetts Institute of Technology.

MR. WALTER H. GAITHER, of Pittsburgh, Pa., has been appointed a member of the Public Service Commissioner of Pennsylvania by Governor Tener for a term of two and one-half years, beginning on January 19. The newly appointed commissioner was born in Foxburg, Clarion County, Pa., 45 years ago, and was engaged in newspaper work in Pittsburgh for several years. He was secretary to Governor Tener during his term as Congressman and has served in the same capacity since Mr. Tener became governor.

MR. F. E. WATTS has been appointed district manager of the Hart Manufacturing Company with offices at 203 Broadway, New York City. Mr. Watts is one of the most aggressive and popular sales engineers in the electrical industry. He is Past Jupiter of the Jovian Order and First Tribune of the New York Jovian League. Mr. Watts recently resigned as eastern manager of the *Electrical World*, having served in that capacity for about a year. Prior to that he was connected with the Sunbeam Incandescent Lamp Department of the Western Electric Company.

JUDGE THOMAS P. RILEY, of Malden, Mass., has been appointed a member of the Gas and Electric Light Commission, succeeding the late Mr. Forrest E. Barker of Worcester. Judge Riley was born in Medford, Mass., in 1875, is a graduate of Boston University Law School and has practiced law since 1901. He was a member of the General Court in 1908-9 and 1910, and was appointed associate judge of the Malden Court in 1911. He has been chairman of the Democratic State Committee. The appointment is subject to the action of the Governor's Council.

MR. JOSEPH B. EASTMAN, of Boston, Mass., has been appointed by Governor Walsh as a member of the Public Service Commission, to succeed Mr. George W. Anderson, who resigned. Mr. Eastman is a native of New York State and is 34 years of age. He has long been identified with the interests of union labor as opposed to the corporations, and is secretary of the Public Franchise League. Mr. Eastman is a graduate of Amherst College in the class of 1904. He received a fellowship from the college and entered upon the study of social and economic questions in Boston, where he connected himself with the South End House social settlement. He represented the street railway unions in the Boston Elevated Railway wage arbitration a year ago, and is now the representative of the union in the controversy of the

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Jan. 4	Dec. 28
American Tel. & Tel. (New York)	116¼	116½
Commonwealth Edison (Chicago)	134	136
Edison Electric Illuminating (Boston)	250	248
Electric Storage Battery common (Philadelphia)	47½	47¼
Electric Storage Battery preferred (Philadelphia)	47½	47¼
General Electric (New York)	139	137
Kings County Electric (New York)	120	120
Massachusetts Electric common (Boston)	—	8
Massachusetts Electric preferred (Boston)	50	50
National Carbon common (Chicago)	116	119
National Carbon preferred (Chicago)	120¼	119
New England Telephone (Boston)	129¼	128¼
Philadelphia Electric (Philadelphia)	23¾	23⅝
Postal Telegraph and Cables common (New York)	70	70
Postal Telegraph and Cables preferred (New York)	67	67
Western Union (New York)	57⅝	57
Westinghouse common (New York)	67½	66½
Westinghouse preferred (New York)	—	—

employees of the Bay State Street Railway Company for wage revision. The appointment comes to the Council for approval.

OBITUARY.

MR. LEO H. SEIFFERT, vice-president of the Seiffert Electric Company, Evansville, Ind., died on December 24, 1914.

MR. WILLIAM H. ESTEY, for the past 12 years connected with the publicity department of the Boston Elevated Railway Company, died at the home of his son in New York on January 1. He was 73 years of age. Mr. Estey was born in Worcester, Mass., and served in the Civil War in the 51st Massachusetts Regiment. On his return he became a reporter for the *Worcester Spy* and later served on the *Boston Herald, Globe* and *Journal*. His home was in Cambridge, Mass.

MR. RODNEY F. HEMENWAY, special agent for the New England Telephone and Telegraph Company, with an office in Boston, died at Lowell, Mass., January 1, aged 56 years. Death was due to heart disease. Mr. Hemenway was born in Natick, Mass., and spent his early life in Milford and Brookline, later removing to Lowell. He was a reporter for the *Lowell Mail* and for the *Boston Herald*. He had been in the service of the telephone company since 1904.

DATES AHEAD.

Electrical Contractors' Association of the State of Illinois. Semi-annual meeting, Hotel Morrison, Chicago, Ill., January 15-16. Secretary, E. J. Burns, Rock Island, Ill.

Electrical Contractors' Association of Wisconsin. Annual meeting, Hotel Wisconsin, Milwaukee January 18-20. Secretary, Albert Petermann, 626 Lloyd Street, Milwaukee, Wis.

Independent Telephone Association of America. Annual convention, Hotel Radisson, Minneapolis, Minn., January 19-21. Secretary, W. S. Vivian, 19 South La Salle Street, Chicago, Ill.

American Wood Preservers' Association. Annual convention, Congress Hotel, Chicago, Ill., January 19-21. Secretary, F. J. Angier, Baltimore, Md.

Wisconsin Electrical Association. Annual convention and joint meeting with Wisconsin Gas Association, Hotel Pfister, Milwaukee, January 20-22. Secretary, George Allison, First National Bank Building, Milwaukee, Wis.

Northern White Cedar Association. Nineteenth annual meeting, Minneapolis, Minn., January 26-27. Secretary, N. E. Boucher, Minneapolis.

Western Association of Electrical Inspectors. Annual meeting, Hotel Radisson, Minneapolis, Minn., January 26-28. Secretary, W. S. Boyd, 175 West Jackson Boulevard, Chicago, Ill.

National Convention of Builders' Exchanges. Columbus, O., January 26-28.

With the Electrical Manufacturers

The Samson Cordage Works, Boston, Mass., has prepared its usual attractive and very handy little calendar for 1915. This bears a handsome reproduction of various sizes of Samson spot cord and an enameled embossed medallion of the "Samson" trade-mark.

Wagner Electric Manufacturing Company, St. Louis, Mo., has opened a sales office in the Pioneer Building, St. Paul, Minn. It is in charge of C. Kirk Hillman, who for some time has been identified with the sales of Wagner apparatus in the district about the Twin Cities.

Roller-Smith Company, 203 Broadway, New York City, has ready bulletin sheet No. 86 on which are illustrated and described direct-current and alternating-current volt-ammeters for the testing of railway electrical signaling systems. Three types of these instruments are made, each in several ranges.

The Sangamo Electric Company, Springfield, Ill., opened offices January 1 at 633 Metropolitan Life Building, Minneapolis, Minn. W. T. White has been placed in charge. Mr. White is tribune of the Minneapolis Jovian League, and well known among electrical men throughout the Northwest as a business booster.

Mathias Klein & Sons, Chicago, announce that they have secured the exclusive right to manufacture and sell the Wasson all-steel reel and cart. This device is already quite extensively in use and is said to have given great satisfaction. Klein & Sons are also sending out their vest pocket calendar, in accordance with the annual custom.

The Robbins & Myers Company, Springfield, Ohio, has issued bulletin No. 111, which deals with its type S steel-frame direct-current generators. These are made in capacities from about 0.25 to 1.50 kilowatts, and for 40, 60 and 115 volts. The bulletin describes the generators in detail and illustrates some typical machines.

The Lagonda Manufacturing Company, Springfield, Ohio, has published catalog L-8 on its various types of boiler-tube cleaners. They are driven by water, air or steam and are made for use with water-tube or return-tublar boilers. The catalog is well illustrated. A number of other boiler-room accessories are also shown and briefly described.

The Kandem Electric Company, Incorporated, 49-53 East Twenty-first Street, New York, N. Y., is distributing complimentary tickets to the trade and extending an invitation to visit its special demonstration at its show rooms where flame, tungsten and nitrogen lamps, flame and picture-machine carbons and all accessories will be exhibited. The tickets are good until January 30, and the display rooms will be open every day except Sundays and holidays.

The Electrical Alloy Company, Morristown, N. J., has opened an office at 180 North Dearborn Street, Chicago, Ill., and appointed Messrs. L. L. Fleig & Company western representatives. The company is the manufacturer of pure nickel resistance materials. These include "Calido" for electrically heated devices; "Phenix" for heavy duty resistances; "Ideal" for electrical measuring instruments and resistances; "Tarnac" for electrical measuring instruments; "Spark Point Nickel" for spark plugs and contacts.

Century Electric Company, St. Louis, Mo., has published a leaflet explaining the distinctive feature possessed by its single-phase motors of being able to operate reliably in dusty and dirty surroundings. This is due to the sliding short-circuiting contacts that change the machines from starting as repulsion motors to induction motors. Illustrations are shown of a motor-driven foundry-sand riddle, a dough-mixer, a band saw, an oat crusher, and a knife-grinding and polishing machine. These machines are typical of the service for which these Century motors are peculiarly adaptable.

The Youngstown Sheet and Tube Company, Youngstown, Ohio, manufacturer of black and "New Process" galvanized sheets, "Buckeye" rigid conduit, enameled and galvanized, and "Realflex" armored conductors, has produced a handsome calendar in large size of more than usual interest. On the first page there is a view of one of the iron mines, a scene of the initial step in the manufacture of the company's products. The subsequent views are of the different departments of the works, illustrating various methods of manufacture and facilities for shipping.

Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has issued several new publications. Bulletin No. 1088 deals with distributing transformers. These are of several types, both for pole and manhole use. A distinctive feature of these transformers is that they have three cooling surfaces. Bulletin No. 1089 describes and illustrates reversing-motor planer drive, including both control and motor equipment. Bulletin No. 1090 is devoted to motor-generator sets of which over twenty different combinations are illustrated. Among these are central-station and railway sets for transfroming alternating current to direct current, or the reverse, electrochemnical sets, frequency-changers, direct-current boosters and balancers, and flywheel power-equalizing sets. Bulletin No. 1452 is entitled "Pulverized Limestone for Acid Soils." It describes the Allis-Chalmer "Hummer"—a machine for pulverizing limestone for use in neutralizing acid soils. Several illustrated

articles on soil acidity and liming are reproduced; these are by prominent agricultural authorities and show the great effect of acidity on fertility. The bulletin contains much valuable information and data on the subject.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., reports receiving the following among recent orders: City of Buffalo, for Massachusetts Avenue pumping station, one 125-kilovolt-ampere motor-generator set (consisting of 125-volt direct-current motor and a 240-volt, 25-cycle, three-phase synchronous generator on common shaft and bedplate), and one 100-kilovolt-ampere, 125-volt direct-current turbogenerator set with switchboard for the control of same. Central New York Gas & Electric Company, Geneva, N. Y., three 1,000-kilovolt-ampere, 22,900/2,300-volt, outdoor self-cooled transformers; three 165-kilovolt-ampere 2,300-volt self-cooled transformers; one 500-kilowatt, 600-volt direct-current, 60-cycle, six-phase rotary converter, with complete switchboard for above apparatus. Hocking Sunday Creek Traction Company, Nelsonville, Ohio, one 400-kilowatt, 1,200-volt rotary-converter set, consisting of two machines on common bedplate, each 200-kilowatt, 600-volt direct-current, three-phase, 60-cycle, and three 135-kilovolt-ampere, 11,000-volt to rotary voltage, self-cooled transformers, with switchboard for the above apparatus. Steubenville & East Liverpool Railway & Light Company, Steubenville, Ohio, one outdoor transformer substation, consisting of two 1,500-kilovolt-ampere, water-cooled, three-phase, 60-cycle, 66,000/16,500-volt outdoor radiator-type transformers; steel work and towers, and outdoor switching equipment; also three 500-kilovolt-ampere, 16,500/2,400-volt transformers, six 24-kilovolt-ampere, single-phase automatic induction regulators with accessories; one 500-kilowatt, 600-volt direct-current, 60-cycle, six-phase rotary converter; one 550-kilovolt-ampere, 60-cycle, 15,000 to rotary voltage, three-phase, self-cooled transformer; two 330-kilovolt-ampere, three-phase, 60-cycle, 15,000 to rotary voltage self-cooled transformers with switching equipment; also two 24-kilovolt-ampere, automatic induction feeder-voltage regulators, with accessories and switchboard apparatus. Among traction companies who have recently ordered Westinghouse Electric railway equipment are the Hershey Transit Company, Hershey, Pa.; Detroit United Railways Company, Detroit, Mich.; Danville Traction & Power Company, Danville, Va.; Birmingham & Tuscaloosa Railway & Utilities Co.

Record of Electrical Patents.

Issued by the United States Patent Office, December 29, 1914.

1,122,259. Motor Control. W. M. Cummiskey, assignor to Gurney Electric Elevator Co., Honesdale, Pa. Provides for automatically connecting a resistance across armature circuit for dynamic braking.

1,122,261. Circuit Controller. W. W. Dean, assignor to Garford Mfg. Co., Elyria, O. Duplex push-button with the second button inside of the first for controlling two or three circuits.

1,122,287. Charging System for Storage Batteries. J. F. Lincoln, assignor to Lincoln Electric Co., Cleveland, O. Motor-generator set with single-phase motor and direct-current generator, latter being fed from battery as a shunt motor to start the induction motor.

1,122,290. Junction Board. H. M. Mack and W. P. Andrick, New York, N. Y., assignors to General Acoustic Co. Includes U-shaped connectors with their arms extending through the board to the cable ends on the front.

1,122,297. Spark Plug. F. J. Muldoon, West Bend, Wis., assignor of one-half to H. Lochen. Covers details.

1,122,326. High-Potential Insulator. L. Steinberger, New York, N. Y. The lower petticoat section can be screwed up to or lowered from the upper section.

1,122,344. Trolley Switch. B. Wilbur, Syracuse, N. Y. Overhead trolley frog.

1,122,345. Cooling Jacket for Thermo-Couples. M. D. Wilbur, Rochester, N. Y. Provides circulation of cooling fluid.

1,122,347. Attachment for Telephones. C. C. Wright, Camden, N. J. Has paper reel above mouthpiece for passing thin sheet in front of opening.

1,122,351. Binding Post. H. F. Adickes, Jr., Biltmore, N. C. Has longitudinal and spiral peripheral grooves for receiving wire.

1,122,358. Detector. L. S. Barr, Washington, D. C. Crystal wireless detector floating on surface of mercury pool.

1,122,380. Electromagnetic Friction Coupling. P. Forster, Turin, Italy. Magnetic clutch with circumferential coil.

1,122,383. Working Submarine Cables. J. Gott, assignor to Commercial Cable Co., New York, N. Y. Upon opening of the key a relay is operated by the discharge of a condenser to reverse connections of battery to line.

1,122,385. Process for Improving the Magnetic Qualities of a Magnetic Body. R. A. Hadfield, Sheffield, England. Silicon steel for electrical cores is first heated to a high temperature, then cooled rapidly, then reheated to the same temperature and finally cooled slowly.

1,122,399. Medical Exploration Illuminator. F. C. Joutras, Union Hill, N. J. Modified flashlight with lamp and battery.

1,122,406. Bushing for Electrical Conduits. A. McMurtrie, assignor to Thomas & Betts Co., New York, N. Y. Outlet-box bushing with set screw for steel-armored conduit.

1,122,410. Heating Regulation. G. E. Porter, Buffalo, N. Y. Circuit-controller governed by dial-type thermometer.

1,122,423. Water Heater. E. H. Ruckle and E. J. Kennedy, assignors to Hughes Electric Heating Co., Chicago, Ill. Resistance units in tube inserted into close-fitting water pipe.

1,122,424 and 1,122,425. Portable Electric Flashlight. C. J. Sagebrecht, assignor to Interstate Electric Novelty Co., New York, N. Y. First patent has outfit arranged like flask in hinged casing; second patent relates to tubular type flashlight.

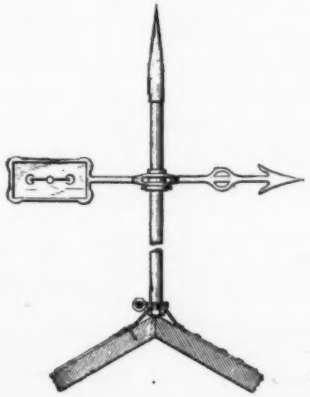
1,122,427. Inclosed Cartridge Fuse. F. W. Schneider, Clay Center, O. Fuse is wound about projections in the end shells.

1,122,430. Circuit-Breaker. W. M. Scott, Berwyn, Pa. Relates to latching means.

1,122,432. Pigtail Connection. W. Shaw, assignor to National Carbon Co., Cleveland, O. For carbon brush

1,122,434. Lightning-Rod Brace. A. J. Steffes, Chilton, Wis. Wire clamp acts as brace for bottom of rod point. (See cut.)

1,122,446. Portable Electric Light. C. Wachtel, assignor to Interstate Electric Novelty Co., New York, N. Y. Lamp at end of battery casing.



1,122,434.—Lighting-Rod Brace.

1,122,468. Electrical Piano-Player. C. E. Brown, Columbus, O. Includes electrically selective clutches.

1,122,478. Electric Safety Fuse. R. C. Cole, assignor to The Johns-Pratt Co., Hartford, Conn. Element consists of two spring heat coils connected by fusible link.

1,122,483. Electromechanical Variable-Speed Device. H. H. Cutler and F. S. Wilhoit, Milwaukee, Wis. Several spur-gear trains controlled through magnetic clutches.

1,122,488. Circuit-Controlling Apparatus. J. W. Eskholme, Westfield, N. J., assignor to C. & C. Electric & Mfg. Co. Automatic step-by-step controller for reversing motor.

1,122,490. Method of Operating Alternating-Current Motors. V. A. Fynn, assignor to Wagner Electric Mfg. Co., St. Louis, Mo. Single-phase compensated commutator motor is started by applying current to brushes and then short-circuiting the brushes.

1,122,491. Alternating-Current Motor. V. A. Fynn, assignor to Wagner Electric Mfg. Co. Has two stator windings and two rotor windings, one of latter being of high and the other of low resistance.

1,122,494. Bowl for Suspension Chains. S. Garvin, Chicago, Ill. Hollow bowl for fixture chain made of spun metal with a loop at each end, having beads upon which the metal of the bowl is upset, the shanks of the loops having passages for electric wires.

1,122,495. Electrical Connection. E. Gindee, assignor to Societe Anonyme Le Carbone, Levallois-Perret, near Paris, France. Carbon brush with metallic tube in which connecting wire is compressed.

1,122,503. Chain Block Hoist. F. A. Howard, Reading, Pa. Operated either by hand or by electric motor.

1,122,521. Electrically Heated Flatiron. C. P. Madsen, Chicago, Ill. The heating unit is connected to the cord wires by main and auxiliary conductors.

1,122,523. Electric Paper-Cutter. C. R. Mannering, New Westminster, B. C., Canada. Electromagnetically operated.

1,122,534. Generator. W. S. Perry, assignor to Vesta Accumulator Co., Chicago, Ill. Has speed-governed contact arm for controlling resistance.

1,122,543. Centrifugal Governor Switch. L. Schaeffer, assignor to H. E. Petty and J. McFeely, Indianapolis, Ind., and M. E. Petty, Chicago, Ill. Operated by centrifugal action to open contact and by gravity to close contact.

1,122,544. Automatic Spraying Device. J. H. B. Shannon, Newark, N. J., assignor to Disinfectant & Utilities Corporation. Includes motor-driven fan and pump.

1,122,555. Electric-Arc Furnace Plant. E. Troyé and E. Edwin, assignors to Norsk Hydro - Elektrisk Kvaelstofaktieselskab, Christiania, Norway. Polyphase furnace with an arc in each phase and a neutral connection between the neutral point of the polyphase transformer and the star points of the arcs.

1,122,556. Automatic Trunking System. F. J. Truby, assignor to Automatic Electric Co., Chicago, Ill. A non-numerical trunking switch with line wipers always in electrical engagement with some one of the trunk lines.

1,122,568. Electric Incandescent Lamp. E. P. Beckwith, Garrison, N. Y. Has flexible metallic holder for determining the position of the filament.

1,122,575. Protective Device. W. L. Cook and G. W. Rodormer, Chicago, Ill. Two tubular fuses on block between which is a serrated carbon ground plate.

1,122,593. Hand Grip for Telephone Standards. J. Harrison, Philadelphia, Pa. Cylindrical split casing adapted to be sprung around the standard.

1,122,594. Art of Transmitting Sounds by Means of Hertzian Waves. W. Harrison, New York, N. Y. Selenium-cell circuit controlled by both light and sound waves so as to produce oscillatory wireless waves.

1,122,605. Store-Service Credit-System Apparatus. C. F. Kettering, assignor to National Cash Register Co., Dayton, O. Auxiliary to telephone is electric stamping device controlled from credit office.

1,122,608. Store-Service System. V. F. King, assignor to National Cash Register Co. Modification of above.

1,122,615. Sender. J. A. Kropp, assignor to Western Electric Co. Calling-dial mechanism for automatic telephone.

1,122,626. Selector Switch. J. L. McQuarrie, assignor to Western Electric Co. For automatic telephony.

1,122,629. Pneumatic Dispatch Tube Apparatus. A. W. Pearsall, assignor to Lamson Co., Newark, N. J. Electric motor drives blower and is automatically controlled.

1,122,632. Connector for Electric Conduits. J. C. Phelps, Springfield, Mass. Has base and removable cap to permit drawing wires in. (See cut.)

1,122,633. Dynamo-Electric Machine. E. S. Pillsbury, assignor to Century Electric Co., St. Louis, Mo. Drawn-steel yoke shell embraces the core laminations and end frames are fastened to this shell through rings.

1,122,642. Multiple Brush Selector. J. N. Reynolds, assignor to Western Electric Co. Automatic telephone switch.

1,122,643. Automatic Control for the Speed of Trains. R. A. Rice and J. A. Rice, New York, N. Y. Electric controll for air brakes.

1,122,645. Overhead Feed Device. S. Rockman, New York, N. Y. Bow trolley collector.

1,122,657. Controller for Electric Motors. H. F. Stratton, assignor to Electric Controller & Mfg. Co., Cleveland, O. Master switch governs automatic acceleration and dynamic braking of motor.

1,122,663 and 1,122,664. Electric Zinc Furnace with Integral Condenser. C. V. Thierry and M. Thierry, Paris, France. Has a carbon-bed resistor.

1,122,665. Spot-Welding Machine. E. Thomson, assignor to Thomson Electric Welding Co., Lynn, Mass. Seam-welding apparatus with several converging welding electrodes and a co-operating mandrel arranged within them.

1,122,667. Overflow-Alarm for Refrigerators. T. M. Tolliver, Washington, D. C. Electric alarm.

1,122,693. Electrical Regulator. F. Conrad, assignor to Westinghouse Electric & Mfg. Co. For generator field excitation.

1,122,743 and 1,122,744. Motor Control System. J. H. Hall, assignor to Electric Controller & Mfg. Co., Cleveland, O. Electromagnetic resistance - short - circuiting switches and means controlled by the operator for delaying their operation.

1,122,752. Signaling and Indicating System for Elevators. W. A. Hoeneman, New York, N. Y. Combined mechanical indicating and electrical signaling system with snake wires for operating the apparatus.

1,122,754. Terminal Clip for Fuse Blocks. D. C. Hooker, assignor to Johns-Pratt Co., Hartford, Conn. Spring clip with loop for receiving the cable terminal and a pair of spring blades for the fuse knife terminals.

1,122,759. Process of Extracting Copper from Ores. N. V. Hybinette, Christiania, Norway. Electrolytic process.

1,122,763. Combined Shade Hanger and Lamp-Socket Support for Lighting Fixtures. W. R. Kahns, assignor to J. H. White Mfg. Co., Brooklyn, N. Y. Consists of L-shaped metallic strip with socket-receiving stud at inner horizontal end and chain-engaging hook at upper vertical end.

1,122,766. Signaling Apparatus. C. W. Kinney, Worcester, Mass. Rotatable drum with spaced terminals of circuit and a series of radial and angular grooves with metallic balls adapted to roll by gravity in the grooves into contact with the terminals.

1,122,774. Method of Controlling Electric Energy. H. W. Leonard, Bronxville, N. Y. Storage-battery charging system in which the voltage is rhythmically varied to give charging current pulsating between maximum and minimum values, the average value being constant.

1,122,776. Signal for Motor Vehicles. L. I. Lovett, Washington, D. C., assignor of one-half to J. F. Hamilton. Solenoid-operated direction-indicating semaphore.

1,122,777. Electric Switch. A. S. Lyhne, Bridgeport, Conn. Spring switch for pocket flashlight.

1,122,778. Portable Electric Lamp. A. S. Lyhne. Pocket flashlight with special cell connection.

1,122,788. Motor Control System. J. F. Motz, Pittsburgh, Pa. Starting resistance can be shunted around armature for dynamic braking.

1,122,794. Automatic Steering Device. A. T. Nelson and C. A. Klawiter, assignors to Automatic Steering Co., Milwaukee, Wis. Electric steering system controlled through contacts on magnetic compass.

1,122,799. Relay, Microphone, or Other Sensitive Contact Device. P. O. Pedersen, Copenhagen, Denmark. Carbon rsistance particles are put under additional pressure when not in use and relieved of extra pressure when in use in order to augment sensitiveness.

1,122,809. Combined Lock and Alarm. J. J. Slepicka, Chicago, Ill. Electric alarm.

1,122,815. Trolley. F. Strosser, Cleveland, O. Has two wheels in tandem.

1,122,828. Switch Movement. B. C. Webster, assignor to Harvey Hubbell, Inc., Bridgeport, Conn. Key switch for lamp socket.

1,122,830. Cigar Moistener. T. L. Wiese, Milwaukee, Wis. Includes electric heater and thermostatic control.

1,122,843. Lamp. E. G. K. Anderson, Chicago, Ill. Incandescent lamp in long insulating tube for dental and surgical use.

1,122,863. Electrical Conductor. P. Clingman, New York, N. Y. Sectionalizing joint in high-tension trolley.

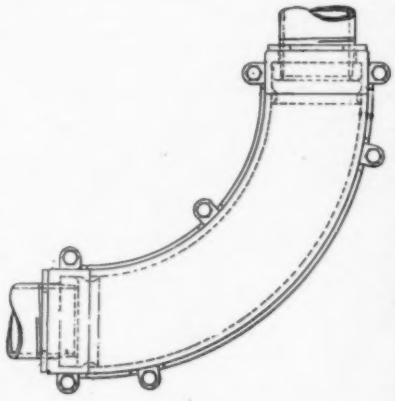
1,122,892. Electric Heating Apparatus. D. Farrand, Newark, N. J. The liquid-circulating pipes constitute secondary windings of a transformer.

1,122,911. Shade Support. J. E. Graybill, York, Pa. The holder has grooved annulus fitting on screw-like bead on socket.

1,122,927. Trolley. R. B. Hinton and O. Kort, Los Angeles, Cal. Includes conducting roller.

1,122 931. Motor Controller. A. J. Horton, White Plains, N. Y. Control station for the motor has two push-buttons adapted to effect either continuous or limited operation of the motor.

1,122,942. Electric System for Transmitting Angular Positions. P. Kaminski, assignor to Siemens & Halske A. G., Berlin, Germany. Remote control for two motors, one for fine adjustment and the other for coarse adjustment.



1,122,632.—Conduit Connector and Pull Box.

1,122,947. Electrode for Therapeutical Apparatus. F. M. Kidder and M. H. Kidder, New York, N. Y. Spoon-shaped electrode with insulating handle.

1,122,962. Electrically Operated Drop Hammer. J. D. MacDonald, Pittsburgh, Pa. Electromagnetically lifted and forcibly dropped ram and electric control for same.

1,122,975. System for Generating Electric Currents of High Frequency. T. B. Miller, Seattle, Wash., assignor of one-half to Smith Cannery Machines Co. Includes alternating-current motor, rotary spark gap, transformer and an iron bar armature adapted to be rotated end over end by the motor and disposed in the transformer magnetic field.

1,122,980. Dynamo-Electric Machine. S. H. Mortensen, assignor to Allis-Chalmers Mfg. Co., Milwaukee, ,Wis. Relates to the collector rings and collector leads.

1,122,998. Valve-Grinder. G. F. Peterson, Salt Lake City, Utah. Motor-driven.

1,123,002. Separable Attachment Plug. C. D. Platt, Bridgeport, Conn. Two-part plug, one part having a pair of contact clips fitting into recesses on the other, or threaded, part.

1,123,009. Automatic Furnace Regulator. F. A. Richards, Muscatine, Iowa. Electric control for dampers.

1,123,012. Rain Signal. J. A. Roby, Detroit, Mich. A switch-holding cord near the discharge of rain cup passes a container with a chemical which when wet will blaze and burn the cord, whereby the alarm circuit is closed.

1,123,017. Ignition Device for Internal-Combustion Engines. F. Schröter, Wilmersdorf, Germany. Spark plug.

1,123,060. Ground Clamp. L. B. Abbott, Bridgeport, Conn. A band encircling a pipe with means for tightening it to hold a wire in position between its ends.

1,123,067. Means for Adjusting from a Distance Any Desired Objects. H. Barkhausen and P. Kaminski, assignors to Siemens & Halske A. G., Berlin, Germany. Electric remote control for a vertically movable rack.

1,123,072. Time Switch. J. E. H. Beràud, Asnières, France. Controlled by an air bell floating in one of two vessels containing mercury.

1,123,074. Coupling for Electrical Conductors. W. L. Bliss, assignor to Central Trust Co. of New York. Between cars of a train.

1,123,085. Coil Support. A. J. Brown and R. B. Williamson, assignors to Allis-Chalmers Mfg. Co. For supporting the end turns of the stator coils.

1,123,092. Apparatus for Mixing Gases and Liquids. G. Calvert, London, England. For hydrogenization of oil; includes electric motor in a chamber for operating the mixing means.

1,123,097. Rubbing or Polishing Machine. D. L. T. Clemons, assignor to C. Mattison Machine Works, Beloit, Wis. Driven by a vertical electric motor.

1,123,098. System of Distribution for Oscillatory Electrical Currents. L. Cohen, Cambridge, Mass. Wireless system includes a tuned antenna circuit, a second tuned circuit and an independent condenser of relatively small capacity arranged to form a coupling between the two circuits.

1,123,100. Automatic Electric Block-Signaling System. M. Conrad, Adrian, Mich., and W. G. Kelly, Winslow, Ariz. Movement of train releases signal locks.

1,123,118. Signaling System. L. de Forest, New York, N. Y., assignor to Radio Telephone & Telegraph Co. Oscillatory generation system includes a high-frequency oscillation circuit and a carbon arc electrode arranged in the circuit and having a solid body forming a core of hydrocarbon material.

1,123,119. Secrecy System for Wireless Communication. L. de Forest, assignor to De Forest Radio Telephone & Telegraph Co. Has means for continuously radiating electrical oscillations of different wave lengths and means at the receiving station for converting the received oscillations into currents of low frequency.

1,123,120. Arc Mechanism for Systems of Space Communications. L. de Forest, assignor to De Forest Radio Telephone & Telegraph Co. Provides means for playing a jet of water on the near surfaces of the arc electrodes.

1,123,121. Timer and Distributer for Electrical Ignition Purposes. J. B. Frawley, assignor to Pittsfield Spark Coil Co., Dalton, Mass. Relates to special make-and-break devices.

1,123,122. Fire Alarm Box. J. J. Ghegan, Newark, N. J. Breaking the glass plate releases a make-and-break signal means.

1,123,135. Method of Determining Power Transmission. L. N. Morscher, Lawrence, Kans., assignor to himself and I. Hill. Consists in producing lateral vibrations in the tight and slack sides of the transmitting belt and electrically determining the speed of travel of the vibrations.

1,123,147. Instrument for Magnetically Recording Sound Vibrations. J. C. Sherman, Brookline, Mass. Telegraphone includes a motor and recording magnets.

1,123.161. Dynamo-Electric Machine. E. J. Andrews, Chicago, Ill., assignor of one-fourth to G. L. Chindahl. Armature winding includes a circuit-changer for changing the series and parallel relation of the coils.

1,123,185. Acoustic Apparatus. W. B. Featherstone, assignor to A. C. Brown, Kansas City, Mo. For producing and distributing music from sound records over a set of telephone circuits.

1,123,187. Attachment Plug. H. R. Gilson. Baden, Pa. The body and cover are each provided with a casing-engaging detent.

1,123,205. Vehicle Lamp. W. F. Anklam, assignor to C. M. Hall Lamp Co., Detroit, Mich. Two superproposed electric headlights, one of high power and the other of low power.

Reissues.

13,853. Driving Mechanism for Electrically-Propelled Vehicles. J. Krohn, Chicago, Ill. Original No. 1,032,068, dated July 9, 1912. Has a pair of intermeshing internal and external gears.

13,856. Automatic Circuit-Breaker. E. C. Raney, assignor to Automatic Reclosing Circuit Breaker Co., Columbus, O. Original No. 1,041.161, dated Oct. 15, 1912. Includes a comparatively high resistance having one terminal connected to the supply side of the breaker.